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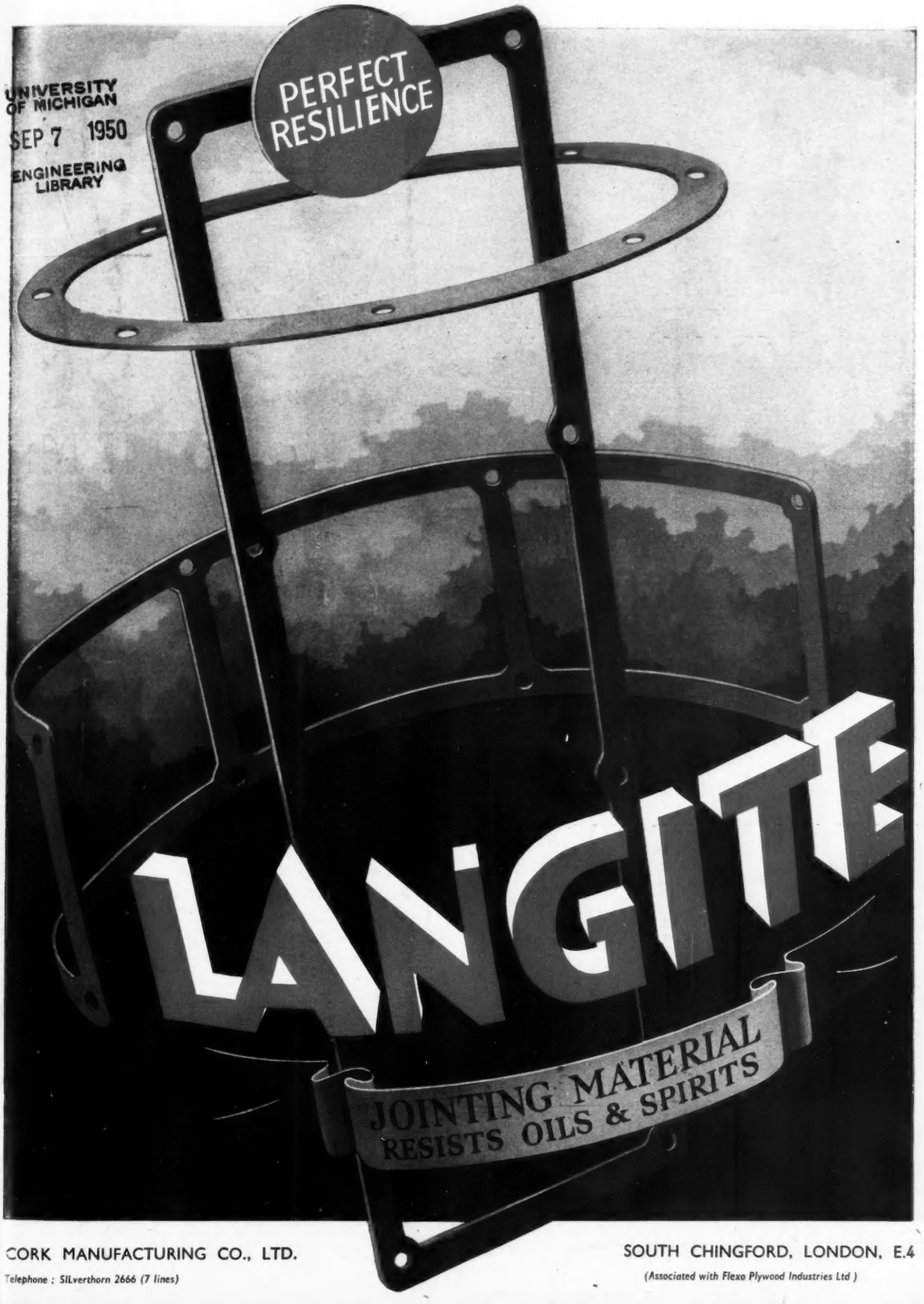

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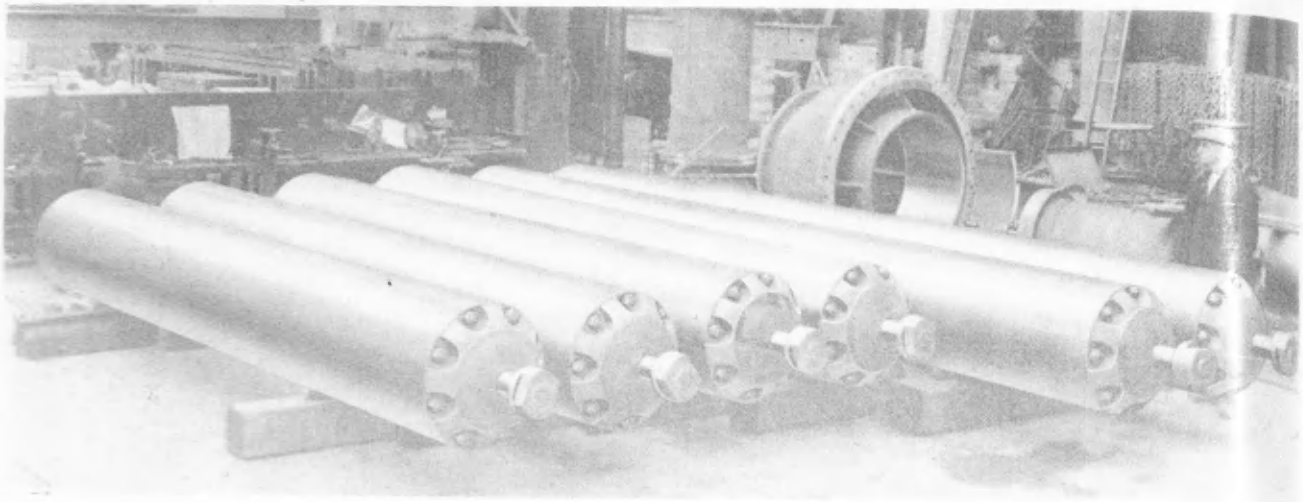

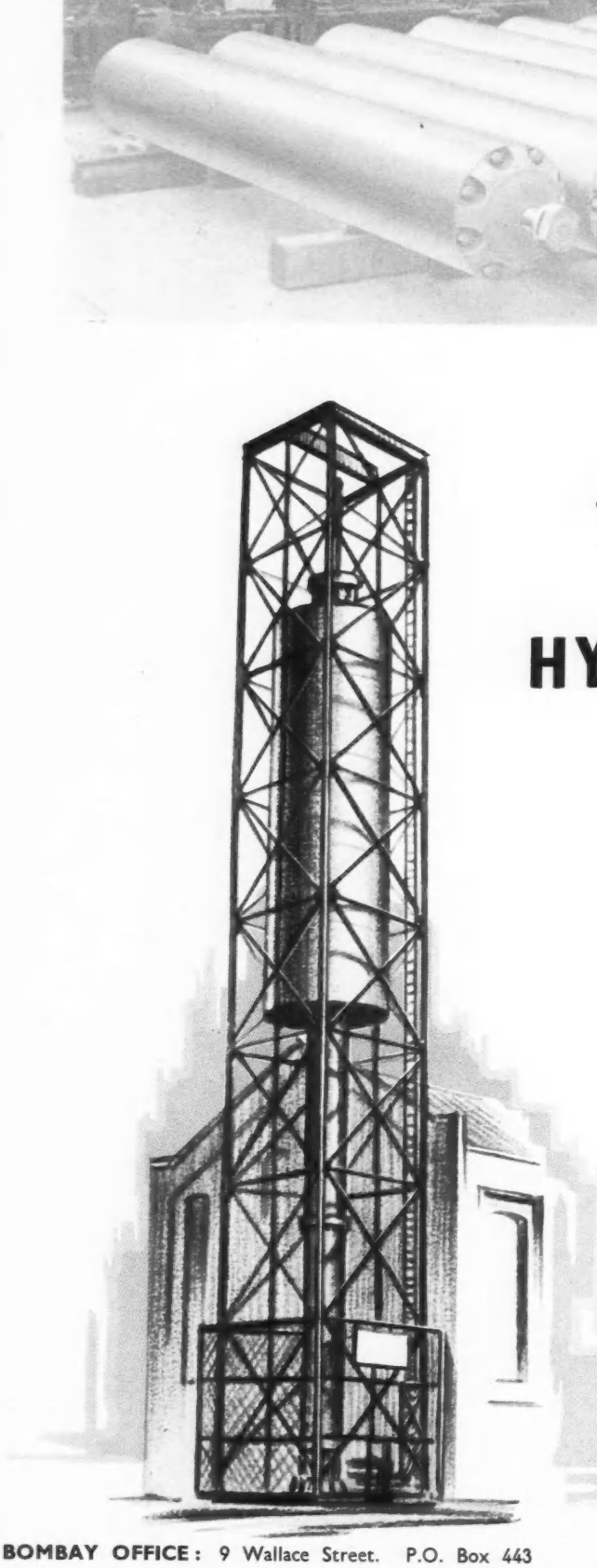

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Ministry of Works Annual Report

THE annual report of the Ministry of Works states that the value of all building and civil engineering work undertaken last year was £1256 million compared with £1181 million in 1948. These figures include the value of the output of the direct labour staffs of public authorities and private firms outside the building and civil engineering industries. Of the £1256 million the estimated value of output for factories and industrial premises is just over £87·6 million, this sum including the value of work carried out under annual maintenance licences and work exempted from authorisation and licensing. During the year 192,174 individual applications for building licences were made to the Ministry and licences to a total value of £258,401,000 were issued. Of this total licence value some £172,488,000 was for factories, works, industrial premises, shops and commercial premises. The labour force in the building industry in 1949 remained much the same as in the previous year, and was fully extended in the building programme, unemployment being almost negligible. The report points out that in connection with site organisation and costing there is general agreement that an important contribution to the reduction of building costs and the increasing of productivity can be made by the planning of building work as thoroughly and as far ahead as possible, and by the systematic organisation of the work as it proceeds. Closely linked with this is the question of better organisation on the site, and the use of the best methods of doing jobs, including not only their orderly arrangement, but also the use of mechanical aids and plant. The Ministry has accordingly co-operated closely with the industry in introducing systems and methods directed to these purposes. It has also drawn attention to the desirability of the keeping of records of expenditure by the various trades, and on the different operations and stages of building. It enables the builder to watch expenditure and to compare expenditure with estimated cost; it also provides a record for the pricing of future work and information for working out final costs. On the subject of exports the report states that building materials to the value of £21 million pounds were sold abroad during the year and towards these exports cement and glass made outstanding contributions. The maintenance work on Government buildings cost nearly £11½ million during the year, and some £30 million were spent on the erection of new buildings.

Developments in Air Traffic Control

THE Ministry of Civil Aviation has announced a newly inaugurated radio telephone system for aircraft which is shortly to be put into operation in the British Isles. By means of this scheme direct conversation will be possible between pilots and control units situated throughout the British Isles, and its approaches. The extension of a v.h.f./radio-telephone service to pilots, which is claimed to be the first of its kind in the world, has been initiated and developed by the Directorate of Telecommunications of the Ministry of Civil Aviation in conjunction with the radio industry. On the Ministry of Civil Aviation stand at the forthcoming S.B.A.C. display, a large area will be devoted to the demonstration of this scheme in operation. This demonstration will employ a large animated map on which will be depicted, by means of light flashes, the communication scheme using four aircraft approaching London on different routes. The landline communications will also be demonstrated by coloured lights on a map. A further innovation in the control of air traffic is the recently announced automatic monitoring recorder, of which a fuller account is given elsewhere in this issue. With these instruments a continuous record can be made on ordinary Kodak 32mm film of all communication between aircraft and control centres. Apart from its intrinsic worth as a source of reference in the event of accident, it is hoped that the existence of such a record will help to maintain the highest standard of R/T technique and procedure so essential to landing and departure operations at congested airports in blind flying conditions. Whilst the eventual extension of this service to the R.A.F. is assumed, its subsequent use by the B.B.C. for its monitoring services is anticipated.

Dover–Calais Submarine Cable

THE centenary of the completion of the laying of the first submarine cable between Dover and Calais by the brothers J. W. and Jacob Brett will be celebrated on August 28th. That event, by establishing telegraphic contact with the Continent, marked the beginning of international communications as they are known to-day. In honour of the occasion and to demonstrate the remarkable worldwide facilities which are now available via the extensive network of submarine cable, an exhibition has been organised by the Science Museum, with the co-operation of the General Post Office, Cable and Wireless, Ltd., Western Union Telegraph Company, Ltd., Telegraph Construction and Maintenance Company, Ltd., Siemens Brothers, Ltd., and the Institution of Electrical Engineers. The work of Cooke and Wheatstone, beginning in 1837, and the early essays in land telegraphy will be described. The Gutta Percha Company, formed in 1845, made the original cable, and its successor, the Telegraph Construction and Maintenance Company, Ltd., forming part of the Telcon organisation, is not only closely associated with the exhibition, but is having a deferred celebration of its own centenary. The cable laid in 1850 to join France and Britain and the laying of the early Atlantic cables will be illustrated, and also the expansion to the present-day network covering the world. The first cable was of simple construction, consisting of a gutta percha covered copper conductor. Appropriate exhibits will trace a century of development illustrating the increase in size, capacity and technical complexity as exemplified by the latest link between Belgium and Britain, which is a semi-air-spaced coaxial cable, capable of dealing with 240 simultaneous telephone calls. The methods of manufacture and repair of cable will be shown, together with modern practice and future trends. In another section of the exhibition there will be on view models of ships specially designed for cable laying and for cable repairing. Working exhibits will form an interesting feature and the transmission of messages and the receipt of replies will be demonstrated. As a permanent record a handbook, entitled "100 Years of Submarine Cables," has been compiled and should prove useful as a work of reference. The exhibition will be open from August 29th to October 28th.

Water Supply at Glasgow

IN our issue of April 28th last, page 503, a description was given of the post-war works of the City of Glasgow Corporation Water Department, which had recently been inaugurated. It may be recalled that these works involved the construction of a 36in diameter main some 14 miles long, service reservoirs and a pumping station, the total cost being about £809,000. In the annual report of the Water Department for the year ended May 31, 1950, reference is made to these works as the most important feature of the year's activities. The report states that it is gratifying to be able to record the completion of works of such magnitude so early in the post-war period, having regard to the continued complaints by other water authorities that they are unable to start new works required to meet their supply problems. The laying of a second main, the west main, is now in progress. This work was started last November, and various reservoirs and water towers are being designed by the Department. Contracts for the supply of valves and pipes for a line of 48in diameter steel pipes required to cross the Endrick and Blane Valleys, were placed during the year, and this work should start in 1951. When it is completed, the maximum supply from Loch Katrine to Milngavie reservoir will be increased from the present figure of 92 m.g.d. to 110 m.g.d. A study was undertaken during the year of the rainfall records kept by the department for the past ninety-seven years, and a computation made by modern methods of the reliable yields of the various catchment areas. The results of this investigation made it apparent that new sources of supply were required as soon as possible, and recommendations for the construction of additional reservoir works in Glenfinlas are being prepared by the Department.

Launch of H.M.S. "Dainty"

H.M.S. "Dainty," a "Daring" class destroyer, was launched on Wednesday, August 16th, from the yard of J. S. White and Co., Ltd., at Cowes, Isle of Wight, and the naming ceremony of the vessel was carried out by Lady Lang, who is the wife of the Secretary of the Admiralty. She is the fifth vessel of her class to leave the stocks, the earlier vessels being named "Decoy," "Daring," "Diamond" and "Defender." Her dimensions are the same as her immediate predecessor, H.M.S. "Defender," the extreme length being 390ft., associated with a beam of 43ft. The hull is of welded construction and the design has been influenced by many lessons which were learned during the second World War. Habitability of the living quarters of the officers and men has received special consideration, including internal decoration in pastel colours; the galleys are all-electric; space has been found for a modern laundry; and washing facilities have been brought up to date. Another item of interest is that special labour-saving devices for cleaning ship have been provided. The machinery, which is being constructed by the shipbuilders, is of advanced design. A complete set was on view at the Pametrada Research Station in May. When complete, the "Dainty" will mount six 4·5in guns and six other guns, and there will be two pentad torpedo tube mountings on deck.

Naval Standardisation

A STATEMENT has been issued by the Admiralty giving some particulars of the measures which have been taken by the British, Canadian and United States Navies as part of the arrangements designed to make possible a military standardisation programme applying to all the armed Forces of the three countries. This programme has for its aim the gradual development of common designs in arms, equipment and training methods. A report has been completed by a committee drawn from the three navies, which has been investigating the problems associated with standardisation for some time. The report is stated to have received the approval of the Chief of Naval Operations in Washington, the First Sea Lord, the Admiral of the Fleet, and the Chief of Naval Staff in Ottawa. It recommends inter-staff discussions, by "working level members," under the following headings:—Sea command tactical requirements, communications, naval control of shipping, naval air operations, air defence of forces at sea, submarine and anti-submarine operations, minelaying and mine counter-measures, operations by coastal forces, amphibious operations, defence of ports and bases, sea exercises and training, and logistics. These discussions, it is stated, should be followed by detailed studies of individual items in order to reduce operational and technical obstacles between the navies, achieve economy of effort, and provide a step towards the fulfilment of wider arrangements for general military standardisation.

Productivity in British Industry*

No. IX—MECHANICAL HANDLING

PART II—(*Continued from page 143, August 11th*)

By F. GARNER†, M.I.Mech.E., and A. SIDDALL‡, M.I.Mech.E.

TYPES OF MECHANICAL HANDLING EQUIPMENT AND APPLICATIONS

Group 2.—Fixed and Semi-Fixed Systems.—Conveyors, chutes, hoists, cranes.—As previously indicated, the correct choice of chute, conveyor or hoist for the particular job is a problem which does not settle itself. The types of equipment of this kind which have been developed and proved are now numerous and comprehensive. In the chute and conveyor field components frequently necessitate equipment designs which are special for the particular shape of product.

Decision on the most suitable equipment can only be made after answering the following questions :—

(*a*) What is the nature of the material to be handled and in what volume per hour or minute ?

(*b*) Does material require to be moved vertically at any stage and what is the minimum effective horizontal movement required ?

(*c*) Is material subject to damage if a simple chute system is used ?

(*d*) Is material in such a form that it will roll along a system of rails or alternatively a roller track ?

(*e*) Is the manufacturing cycle such that an " operator to operator " system is all that is required ?

(*f*) Do a number of work stations have to be fed with the component or assembly at the same stage of manufacture ?

(*g*) Has the system to be such that process work (viz., painting, drying, &c.) can be carried out before, and/or after, other operations are performed ?

(*h*) Can gravity be used for feeding the material ?

(*j*) Has the system to be such that it acts as a storage conveyor as well as a transporter ?

(*k*) Can production operations be performed on the equipment itself or is it necessary to take from, and place on, equipment at each work station ?

(*m*) Can material be handled conveniently on a straight line system ?

(*n*) Does material have to be separated from waste products during the handling process ?

(*o*) Is it necessary to handle material in single units or a number of units together ?

The answering of the above questions will quickly enable many types of equipment to be eliminated, leaving a few possible alternatives. In general, types of equipment are not competitive and, when thought to be so, it is usually because of a misapplication. There is a right way of mechanical handling for every job.

Main types of fixed and semi-fixed equipment are :—

(*a*) Chutes : timber, steel, canvas, rail, vibratory, spiral, telescopic.

(*b*) Lifts and hoists—Lifts : hand, power, electric, hydraulic, pneumatic. Hoists : automatic, semi-automatic, skip, elevator fixed, elevator portable, lowerator, twin chain, belt, swing tray, fixed tray, stabilised tray, single chain, bucket. Hoist units : chain, electric, pneumatic, steam, ratchet puller.

(*c*) Conveyors—Monorail systems : carrier, trolley, chain trolley, enclosed chain, trolley with rotating mechanism, pusher. Roller (gravity) : plain, V-trough, spiral, portable, multi-deck. Roller (live) : gear, chain, push bar, magnet. Wheel : wheel, disc, cable drive. Belt : flat, troughed, mattress, telescopic. Drag : pusher-bar, screw, flight, rotary, *en-masse*, chain, floor chain, drag scraper. Apron : wood slat, metal slat, carrier chain pan, feeder. Transfer: ball, castor.

(*d*) Cranes — Overhead bridge : fixed, travelling, cab drive (power), push type, chain (manual). Gantry : fixed, travelling, portable, folding jib, portal, semi-portal, tower. Jib : portable, wall, bracket, rotary, column, pillar, travelling, folding jib. Specials : locomotive, derrick, cantilever, wharf, floating, cableways, suspension (telpher), tramway.

The following general basic rules can be used as a guide in the selection of equipment in the fixed and semi-fixed class of mechanical handling devices :—

Presswork.—At first sight it might be imagined that good mechanical handling in press shops would be a comparatively simple objective to attain. In point of fact, such handling is generally performed in the least efficient manner compared with other types of production.

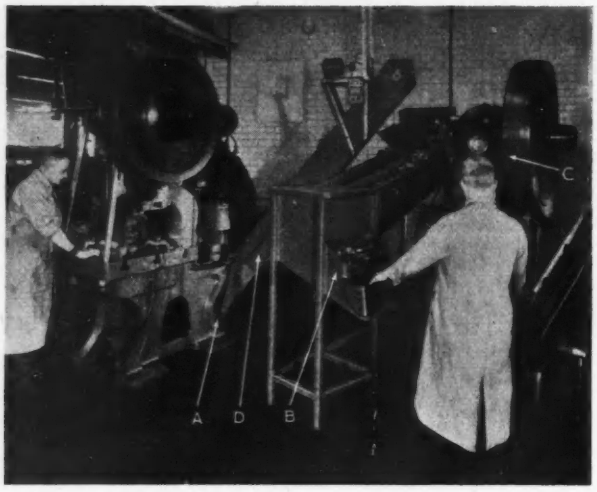
Whilst it is not intended to consider in detail press technique, the use of comprehensive tooling, the extended use of coil material into the heavier gauges, the use of transfer presses and dieing machines, contribute largely to the solution of the work movement problem.

There still remains a great deal to be done outside the above sphere. The following points should be watched :—

(*a*) Material should be cut in a cutting section and placed once in a mobile strip carrier for transfer direct to press, where it is to be used, the material being fed direct to the press where possible. Too frequently strips are handled four or five times before reaching the press tool (see Fig. 4, Part I).

(*b*) Where possible, lines of presses should be used for multi-operation work—it is frequently possible even when considered unworkable. Air or mechanical ejection between presses should be practised or, alternatively, " pressveyors " should be used to elevate and deposit into hoppers (see Figs. 5 and 6) for subsequent operations. The pressveyor-mobile hopper method can be used in general press shops where line production is not possible due to small quantity requirements.

(*c*) Laminations for stators and armatures, &c., should be handled by means of stacking



A typical example of mechanisation of work movement from the bottom of one power press *A* to the feed hopper *B* of a second press *C* for a further operation. The elevator *D*, known as a " pressveyor," is shown at an angle of approximately 45 deg. Such equipment eliminates the use of boxes for collecting work under one press and then carrying to the next machine and lifting up to the working height.

FIG. 5

Application of a "pressveyor" *A* similar to Fig. 5, but in this case the work is a steel forging *B* being passed at forging temperature from a first to a second operation press in a matter of a few seconds instead of manually handling between operations.

FIG. 6

* No. I, " An Introductory Survey," by B. White, appeared February 17th ; No. II, " The Threshold of Productivity," by F. A. Martin, March 3rd ; No. III, " High Productivity and Production Costs," by Sir Claude Gibb and Gordon M. Baker, March 17th ; No. IV, " Standardisation in the Aircraft Industry," by E. C. Bowyer, March 31st ; No. V, " Restrictive Practices," by Arthur Woodburn, April 21st ; No. VI, " Research for Productivity," by Dr. D. F. Galloway, May 19th ; No. VII, " Consequences of Simplification," by W. D. King and H. Sherburn, June 30th ; No. VIII, " Works Extensions," by C. K. F. Hague, July 28th and August 4th.

† Director, Joseph Lucas, Ltd.

‡ Director, Chief Production Engineer, Joseph Lucas Electrical), Ltd.

rails direct to separating and assembly fixtures. Exceptions to this rule are very few.

(*d*) The press shop lay-out in general should be such that strip, coil material and webbing travel the shortest possible distances—an obvious rule frequently disregarded. The use of scrap choppers for webbing can be adopted in practically all set-ups; this facilitates transport of webbing.

Roller track used for inter-operation transport of die-cast motor bodies on a machine line of ten machines. This system prevents damage to precision machined surfaces and is flexible and comparatively cheap. Work is off the floor and there are no work boxes to handle.

FIG. 7

Machined products.—Guides to the handling of light to medium iron castings, forgings and pressure castings, &c.:—

(*a*) Use chutes between work stations if possible.

(*b*) Roller-track, adjustable for slope, and of correct width for the particular component, is sometimes preferable where certain machined faces may have to be protected from damage (see Fig. 7).

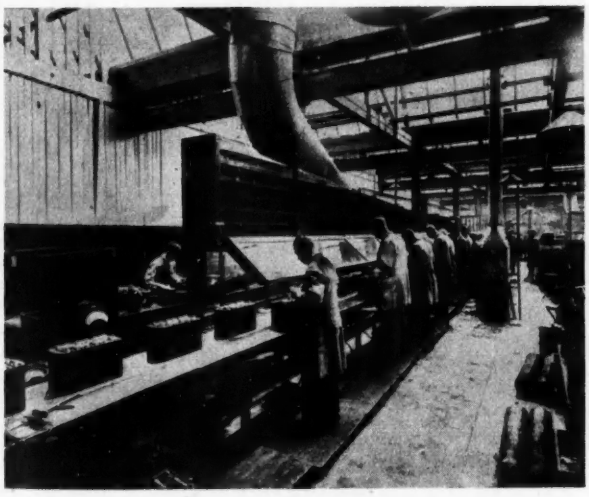
(*c*) Rails on which components may be rolled, using slope for gravity feed, are frequently applicable to round components (see Fig. 8).

(*d*) It frequently happens on bar components, small forgings or castings requiring subsequent operations, that a number of machines are engaged on the same operation, e.g., gear-cutting, and consequently the simple chute or track system is not applicable. One solution is the roundabout chain conveyor carrying containers holding components in small bulk. The operative takes from the conveyor a container of work and, after completing the operation, transfers each component to the second container, which, when full, is placed on the conveyor. A number of different components can be handled on one machining line by such a system. Multi-tier container carriers can be used for different components. A monorail system can be used instead of a floor conveyor, but has little to recommend it for this particular application, unless only one or two operations are to be carried out and the same conveyor is used for transfer to some distant process section or stores. The advantages of the container-carrying conveyor are that operatives have to take work from the conveyor only at long intervals and consequently maintain maximum productivity as far as work-handling is concerned. At the same time, accumulation of static work around machines is avoided.

(*e*) Previous schemes outlined are often not applicable to the larger castings and forgings. It is frequently permissible to use a monorail with suspended work carriers for such jobs. In general, cycle times are much greater than for smaller components and consequently time lost in taking from the monorail and replacing after the operation are a small percentage of the machining cycle and can be tolerated. Ingenuity is sometimes required in such schemes in the design of work-holders, so that loading and unloading of components to conveyors is quick, effortless and safe. Chain type floor conveyors, instead of the overhead monorails in some instances will enable the objectives to be more easily attained. Roller

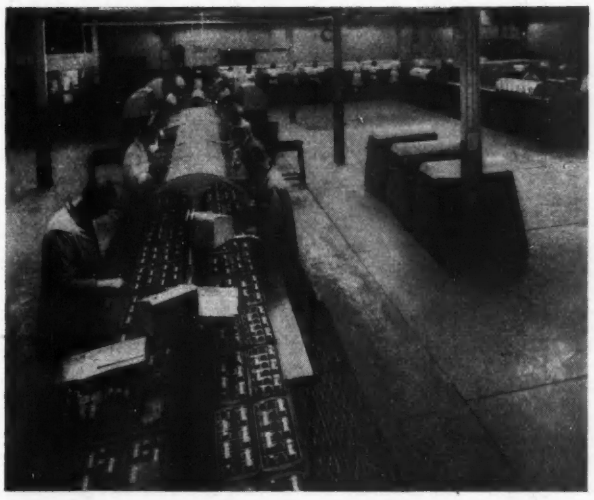
This small motor armature core line depends on a rail system for handling through all operations up to the winding stage. The system, based on an accurate work balance, ensures good work flow and damage-free products as there is no stacking on the floor or in boxes.

FIG. 8



This photograph illustrates an old method of mechanically handling vehicle batteries on main assembly. Batteries were carried, widely spaced and in single line, by a steel band conveyor travelling at the back of the main assembly bench. For a given output rate the speed of travel was too great for work to be dealt with directly on the band. Assembly operations were therefore performed on a continuous bench running in front of the operators and this involved pulling batteries off the conveyor at each station and pushing back again. Fig. 10 shows the latest method.

FIG. 9



This photograph shows the latest method of assembling motor vehicle batteries. Fig. 9 is the old method. The present arrangement entirely eliminates manual handling. Batteries are placed close together in four continuous rows on a slat conveyor and are worked on from both sides. For a given rate of output the linear speed of the batteries is now sufficiently low to permit all operations to be carried out directly on the conveyor, and the bench used on the old lay-out has disappeared. With the closer spacing of work, waiting time for batteries to come along the conveyor is reduced and a better operating rhythm is developed. Note the improved general appearance of the shop compared with the old photograph; overhead ducting for fume extraction has given way to downdraught extraction, fluorescent lighting is used throughout (including the underside of the extraction canopies), the floor is kept clear of all work and a cream colour scheme is used above waist height.

FIG. 10

track can sometimes be used for certain components with at least one large flat face. The advantage over the monorail or floor conveyor for flat-faced work is that lifting of components is eliminated; however, pushing and pulling takes the place of lifting. The logical solution of many handling problems in this class of component is the use of transfer type machines. Unfortunately, considerations of capital expenditure relative to output requirements have restricted efforts in this direction, probably unnecessarily so in many cases.

Fabrication, Assembly, Process and Ancillary Work.—The greatest advance in assembly work-handling during recent years has been the acceptance of the principle that the ideal set-up is reached when all work is performed without removing the product from the work-moving equipment (see Figs. 9 and 10.) The natural sequence of such a principle is that operatives work facing the conveyor and not at right-angles to it. Fixtures, when necessary, are mounted over or behind the conveyor, which frequently takes the form of a continuous narrow belt just wide enough to transport the assembly (see Figs. 11 and 12). For larger assemblies and particularly where assemblies are of awkward shapes, a chain conveyor carrying work-holders may be used.

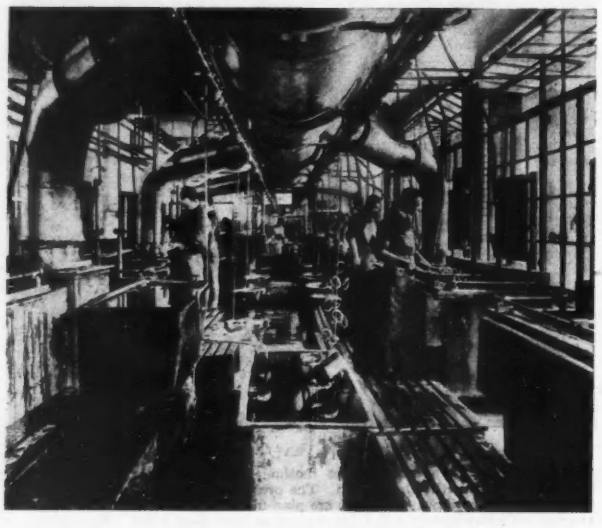
It is not always possible to follow the principle of operators facing the belt. Where large assembly, winding or testing machines are used, it is sometimes not convenient, for

Mechanical handling is no new thing of the post-war era. The above photograph illustrates mechanical handling nearly twenty years ago on light assembly work. Steady and continuous progress has been made and the latest result is shown in Fig. 12. The old photograph shows a wide steel band assembly conveyor running down the middle of a bench. All work has to be taken on and off the band at each work station. Note the large extent to which operators are using their hands as work holders.

FIG. 11

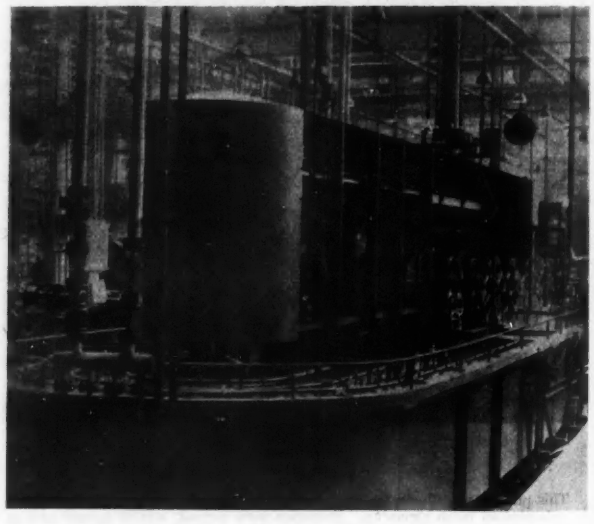
This recent photograph illustrates the progress in mechanical handling on light assembly work since the old picture, Fig. 11, was taken. The class of assembly is the same, but in place of the wide central conveyor there is a narrow belt on each side of the assembly line which passes parts immediately in front of the operators who are working conveniently placed power tools in place of hand tools; hoppers for small parts are well located instead of the small components being on a bench—note that there is no bench space—and operators are using their hands for assembling instead of work holding.

FIG. 12



This photograph, one of the oldest available, and taken about twenty years ago, shows in the centre a monorail conveyor delivering racks of work for electro-plating. "Still" vats are being used which means lifting the racks of components manually in and out of the many cleaning and plating vats involved. But, as in all branches of engineering, successive improvements in mechanical handling have been made continuously in electro-plating, with the result that manual work is now reduced to loading and unloading fully automatic electro-plating machines as shown in Fig. 14.

FIG. 13



The electro-plating installation shown is representative of the entirely automatic continuous installations in general use to-day, and shows the improvement in mechanical handling on this class of work compared with the old photograph, Fig. 13. Work is carried along by a process conveyor built into the machine and components are automatically lifted in and out of cleaning and plating vats as many as twenty times to complete the process. One operator has time to load and unload upwards of 1000 components per hour.

FIG. 14

physical reasons, to place such equipment so that the operative faces the belt, or to eliminate the necessity for a considerable movement of work from the handling equipment to the machine locations. Consequently, such equipment has to be placed at right-angles or some acute angle to the line flow. Operatives should always face the approaching work with such a set-up. In other cases, it is expedient for operatives to carry out a comprehensive building operation as one sequence, and to have a number of operatives on an identical operation. Further, a large number of components of some bulk may have to be handled at each work station. In such cases, operating at right-angles to the belt is again the most effective method to be used, using a roundabout chain conveyor with multi-tier work carriers (see Fig. 15).

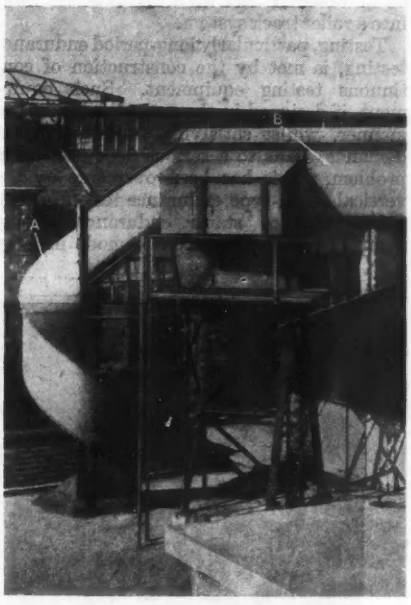
Two roundabout chain conveyors, side by side, handling two varieties of motor vehicle horn through setting and testing operations. The work carriers are protectively coated to prevent damage to the painted product and lower and upper tiers are used for identifying the stage of manufacture of the product. There is nothing on the floor and no damage to work. Any number of testing stations can be fed smoothly by such a system.

FIG. 15

It frequently happens that a combination of conveyors may be necessary to effect the best work-handling on the complete line—e.g., Stage 1—narrow belt, Stage 2—roundabout chain, Stage 3—wide belt. Whichever system or combination of systems is used, the paramount considerations are continuity of flow, uninterrupted feeding of work to operatives and ease of receipt and dispatch of work to and from operatives.

Feeders for assembly lines are just as important as the main building lines. The overhead monorail is frequently used, either carrying components in single units or with suspended carriers for small or medium-sized components. One advantage of such a conveyor is its ability to pick up components at various points in the factory and deliver at the positions required for assembly. In addition, such a conveyor can be used as a process conveyor for cleaning, painting, &c., on its passage from component-producing points to the assembly station. Fig. 14 shows an overhead process conveyor as applied to electro-plating, whilst floor-type process conveyors are shown in Fig. 17.

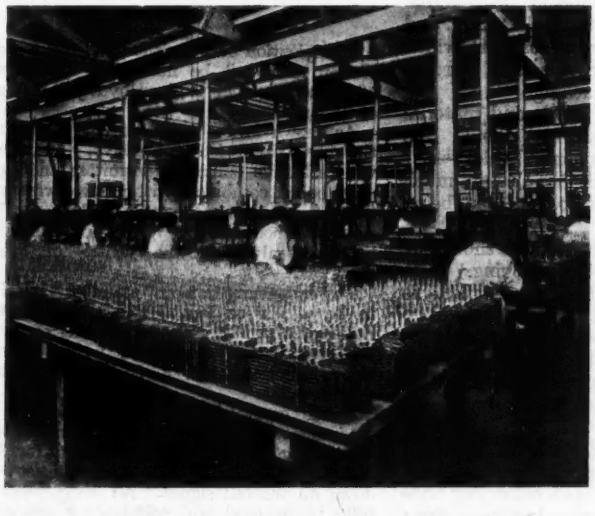
The practice of arranging for major components to join a main assembly line at the required work stations should be adopted in all suitable cases as this is one of the best methods of eliminating work movement.



Packing boxes, both empty and full, are entirely mechanically-handled in a multiple storey building by spiral chutes, band conveyors and roller tracks. The photograph shows the start of a spiral chute *A* on the roof of a factory, for delivering empty boxes to packing stations on each floor. Empty boxes are fed in a pre-planned order from the unloading deck via an elevator and band conveyor *B* and discharged through the spiral chute on to the required floor. A similar chute is used for packed boxes and at ground level a band conveyor with telescopic extension feeds into road vehicles for dispatch. The old method was to use lifts which carried truck loads of empty and full boxes, with much delay, unnecessary handling and low productivity.

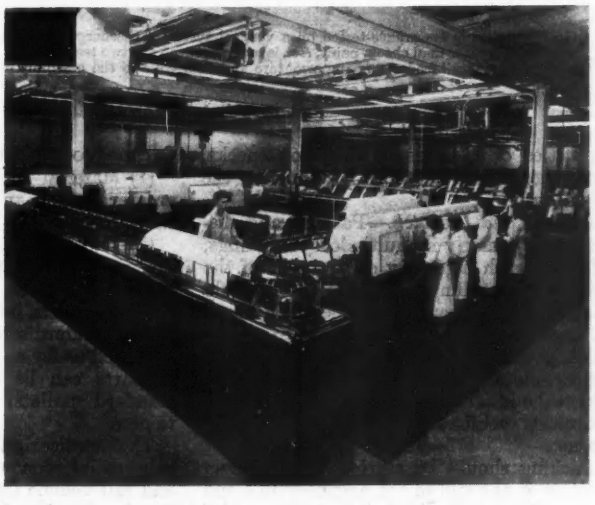
FIG. 19

Checking and Testing.—Work-handling through checking and testing presents



In this old photograph mechanical handling is completely absent. The parts stacked in the foreground are lead-acid battery plates arranged in "sections." The operators carried out, with a hand torch, a finishing operation on these "sections." To-day the operation is entirely automatic along with other operations shown in Fig. 17. The old and new methods show the marked improvement possible between manual and mechanical handling. By the old method each part was picked up and dropped down nine times. Not only has the lifting up and dropping down now ceased, but working conditions for the operators are much improved and there is none of the creation of lead dust that constantly occurred at each movement of the "sections."

FIG. 16



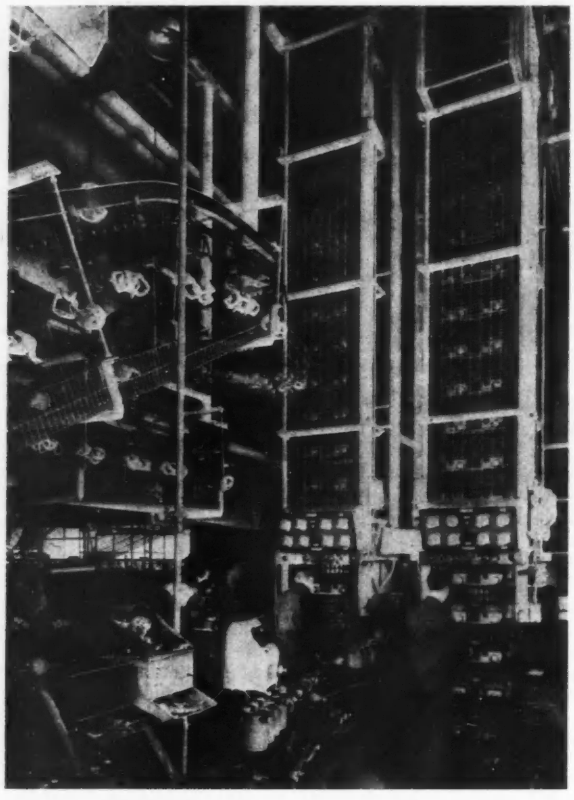
The lead "flushing and finishing" operation shown in Fig. 16 is now carried out automatically as one of several operations on the elliptically-shaped roundabout conveyor machine shown to the right of the centre of the photograph above. This change was not effected at a single step but by continuous improvement over a number of years. Further changes are contemplated. Note that all work is on the move on conveyors, that there is nothing on the floor and that there is a minimum of volume of work in process as distinct from the old photograph where an accumulation is shown on a large bench. Ventilation is much improved. Extraction of lead dust is downwards instead of upwards. The gridded floor is automatically water-flushed to clear lead dust. Fluorescent lighting is used, including underneath the ventilating canopies.

FIG. 17

another range of problems. For example, crack detection of a large volume of bar stock daily presents a formidable handling task, which can be overcome by a continuous crack detector and marking machine built into a roller track system.

Testing, particularly long-period endurance testing, is met by the construction of continuous testing equipment. Such equipment, if designed in the orthodox horizontal manner, whilst satisfying work movement demands, leads to a serious floor utilisation problem. This has been overcome by the vertical chain-type endurance test (Fig. 18).

The use of static endurance testing equipment of small products made in large quantities often leads to flow bottlenecks, which negative good work-handling on the assembly line.



Generators being endurance-tested on a vertical system. Discharge of the tested product for final check, paint, &c., is made between the two test banks. Note the monorail feeder carrying armature and field coils to the assembly line.

FIG. 18

Packing and Dispatch.—Packing and dispatch, particularly in multi-storey buildings, calls for much ingenuity on the part of the mechanical handling engineer. The anomaly of ancient and decrepit vehicles being used to transport finished products from the end of good assembly lines to a ragged packing section and thence down equally decrepit lifts to be manhandled into unsuitable road transport vehicles has to be guarded against.

Packing should be carried out wherever possible at the end of the assembly line and goods subsequently loaded direct or carried by conveyor to road or rail vehicle. An exception to this rule is met when the product is painted as the final operation on the assembly line and a paint-drying period is necessary, in which case it may be expedient to pack at a position remote from assembly.

In multi-storey buildings, packing stations on each floor should, in all suitable cases, be so placed that a single spiral chute can be used for vertical movement of packed products, combined with a horizontal continuous belt to the dispatch deck. The horizontal belt should be linked up with a telescopic belt running into the dispatch vehicle.

The delivery of packing materials to packing stations is almost as important as delivery of the packed goods and necessitates similar handling equipment (Fig. 19).

Group 3.—*Material and Work Carriers.*—Modern internal transport facilities as outlined under Group 1 can only be effectively used if material is in the best form for handling. It is extravagant to have an expensive fork truck standing idle for long periods whilst boxes of work or individual components are manhandled on or off the truck platform.

The following are the more important types of equipment used for material and work carriers :—

Pallets: wood, metal, paper, single base, double base.

Skids : wood, metal, press strip feeder.

Tray packs : wood, metal, paper, compartment trays, strip build-up, bound.

Containers : wood, steel, tanks, tubular, collapsible, corrugated.

Press hoppers : steel, fixed, portable.

Racks : tubular, angle, fabricated.

The use of much of this equipment is still in its infancy and even the nomenclature of the subject is ill-defined. There is a tendency to describe as a pallet any and every carrier which provides for vertical stacking.

Work and material carriers should be designed to the following general rules :—

(1) Material should be handled in much greater bulk than hitherto, the aim being the unit load.

(2) Pallets, skids or containers should be designed to facilitate vertical stacking.

(3) Equipment should be designed to suit the modern internal transport vehicle.

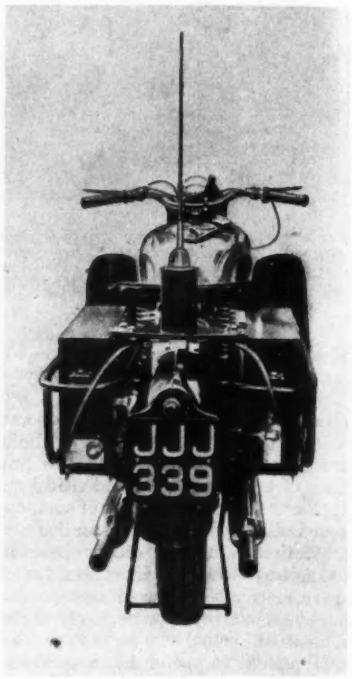
(4) Standardisation of carriers should be extended as far as possible ; a great variety of parts can be accommodated on or in standard pallets, skids, packs and containers.

The application of these rules leads to substantial economies in manpower. Road and rail vehicle loading and unloading time has been reduced in some instances from several hours to the same number of minutes. Much larger units are moved in one journey. Storage space is more effectively used to the extent of four or five times in some cases. Stores control is facilitated by the use of standard loads of known quantities. In addition, damage to materials is frequently reduced or eliminated.

A Frequency-Modulated Transmitter-Receiver for Motor Cycles

A TRANSMITTER-RECEIVER of 10W radio frequency output has been developed by the Plessey Company, Ltd., Ilford, Essex, specially for use on motor cycles, as illustrated herewith. This twenty seven-valve equipment (type P.TR7) is frequency modulated, crystal controlled, and operates on a spot frequency within the 68–100 Mc/s band.

A selective calling system is available whereby one, or all, of ninety units, each consisting of one or more vehicles, may be called from the control station. This sytem can be supplied either to " lock-out " all stations not being called, or to allow these stations to interrupt communication between the fixed and a mobile station should it be necessary. Notification of an incoming call is given by a bell or buzzer and a lamp.



FREQUENCY MODULATED TRANSMITTER RECEIVER ON A MOTOR CYCLE

As shown in the accompanying illustration, the installation is unobtrusive, the receiver with selective calling, transmitter and power unit being combined within two waterproof cases mounted on either side of the rear wheel. As far as possible the weight has been distributed evenly and the centre of gravity kept low.

Power consumption on " standby " is claimed to be as low as 18W. The specified service radius is about 20 miles, depending on terrain and installation conditions, when operating in conjunction with a 20W control transmitter.

Being crystal controlled throughout, the equipment requires no adjustment in operation. Sensitivity is 1 microvolt carrier input for 10 dB quieting. Spurious responses are at least 60 dB down on wanted signal. All components are fully tropicalised and suitable for use within the temperature range —40 deg. Cent. to +71 deg. Cent., with humidity as stated for the Ministry of Supply's specification K110.

It is stated that use of a low multiplication factor obtainable with the recently developed Plessey modulation technique virtually eliminates the radiation of spurious frequencies from the transmitter. Frequency deviation is ±15 kc/s.

Some American Locomotives and their Running

By W. A. TUPLIN, D.Sc., M.I.Mech.E.

No. II—(*Continued from page 146, August 11th*)

Footplate Experiences

AMERICAN hospitality is proverbial; it is extended in full measure to British visitors and nowhere does it exceed that shown by railroad officials. It is with very pleasant memories that the writer acknowledges here the courtesy shown by the authorities of the New York Central system, the Pennsylvania Railroad and the Milwaukee Road (Chicago, Milwaukee, St. Paul and Pacific Railroad) in providing facilities for him to ride on locomotives in fast passenger service.

(1) *The Milwaukee Road.*—It was on the last-named road between Chicago and Milwaukee that the first footplate journeys were made and they had been preceded by an inspection of locomotives and equipment at the Western Avenue and Bensenville round-houses in charge of Master Mechanic L. H. Koch, who, after a busy Saturday morning at the former place personally conducted the writer to Bensenville, 11 miles away, and effected introductions there. The Western Avenue depot is largely concerned with locomotives for working passenger trains from Chicago, whilst Bensenville provides power for freight trains starting from the large freight-marshalling yard of that name.

General conditions in and about these round-houses are similar to those in British sheds, and there is no escaping the fact that to keep steam locomotives running is hard and dirty work. Ash disposal is a major problem and the universal use of rocking and dumping grates with bottom-door ash-pans places America well ahead of normal British practice in that respect.

Locomotives are cleaned externally by a jet of a hot emulsion of water and soluble oil, sometimes followed by hand wiping, but nothing was seen of cleaning such as used to be common in Britain.

The placing of the sandbox on top of the boiler enables it to be filled quickly, and this is done at Western Avenue through a 6in diameter flexible pipe leading from an overhead tank of about 1000 cubic feet capacity fed through an air-lift pipe with sand brought in box cars.

Western Avenue shed is built on the usual American "half round-house" plan with stalls radiating from an electrically powered, fast-moving turntable very smartly operated. It has been known for a locomotive to be run into the turntable pit as the result of some misunderstanding and the resulting hold-up has emphasised the fact that this type of round-house may be an easy victim for evilly disposed persons.

The most favoured locomotives at Western Avenue are the "S2" and "S3" class 4–8–4s (Fig. 3) because they can handle the heaviest freight and passenger trains and the only blemish is that they are not allowed to exceed 70 m.p.h. Such a restriction would make little difference to the operation of any British locomotive at the present time, and still less would our freight trains be affected by the Milwaukee maximum of 60 m.p.h.

Perhaps the most famous Milwaukee locomotives are the class "F7" streamlined 4–6–4s, the record of whose achievements in very high-speed passenger train haulage is unsurpassed anywhere in the world. With loads of 450 tons on level track they can cover the first 7 miles in 7 min. from rest in working up to maxima of over 100 m.p.h., and running of this character is in fact necessary to maintain the schedule of the "Hiawatha" trains. In recovering lost time with these trains, the "F7s" have been timed to average 100 m.p.h. for distances up to 60 miles, and speeds up to 112 m.p.h. were noted on recording tapes before the present limit of 100 m.p.h. was imposed. On the occasion of the writer's first visit to Western Avenue, one of these locomotives, very bright and clean, was seen leaving for the Union Terminal, but he found no opportunity of riding on or behind any of them. He did, however, note the sound performance recorded in Table I of a smaller non-streamlined 4–6–4 of class "F6" (Baldwin), whose engineer interpreted somewhat liberally the nominal 75 m.p.h. limit of these engines.

Western Avenue roundhouse maintains diesel-electric locomotives now widely used on the fast passenger trains, and the writer joined the crew on one of these—Fairbanks-Morse single unit No. 21B—at the round-house before it was attached to its train in the adjoining passenger-car siding. The engineer in charge was V. Williams and the "fireman" R. J. Mishefske, both of Milwaukee.

Fairbanks-Morse Diesel-Electric

The locomotive is rated at 2000 h.p. and is mounted on two six-wheel bogies; each outer axle of each bogie is driven by a nose-and-axle mounted electric motor through spur gearing in the conventional way for electric traction.

In the driving compartment there is an array of handles and indicators, but most of these refer to auxiliaries and running control is effected very much as on a steam locomotive. One handle determines direction, forward or backward, another controls the throttle of the engine, and a third selects motor field winding connections in a manner appropriate to the speed. This latter controller has four positions used for speeds up to 22 m.p.h., from 22 to 32 m.p.h., from 32 to 62 m.p.h., and from 62 m.p.h. upwards. It gives the approximate equivalents of four cut-off settings in a steam locomotive or of four speeds in an automobile gearbox and its resemblance to gearbox control is heightened by the fact that the throttle is closed when changing the speed setting. There is a "dead man's pedal," with delayed action, which cuts off the power and applies the brakes if the pedal is left unloaded for more than a few seconds. In the middle of the "dashboard" is a cab-signalling apparatus giving a visual indication of the aspect of each fixed signal as the locomotive reaches it. On the engineer's side is a wheel-slip indicator, besides a speedometer, the usual air-brake gauges, and switches for the cab heater and window defroster.

Warning lights are provided for low lubricating oil pressure and hot big-ends, and the fireman is provided with indicators of conditions in the automatically controlled oil-fired Clarkson boiler that produces steam at 150 lb per square inch for train heating. In the nose of the body, ahead of the cab, there is much piping and electric conduit, and the engineer looked round this compartment with illumination from an electric hand-lamp as part of such general examination as can be carried out in a "preparation" time of five minutes. The locomotive has a straight air-brake as is usual for American steam locomotives.

After a shunt or two the locomotive was attached to the head end of Train No. 27, made up of seven vehicles (about 440 tons) and proceeded to propel it under directions transmitted from a pilotman at the far end of the train to the driver by the conductor's pneumatic signal, from the Western Avenue

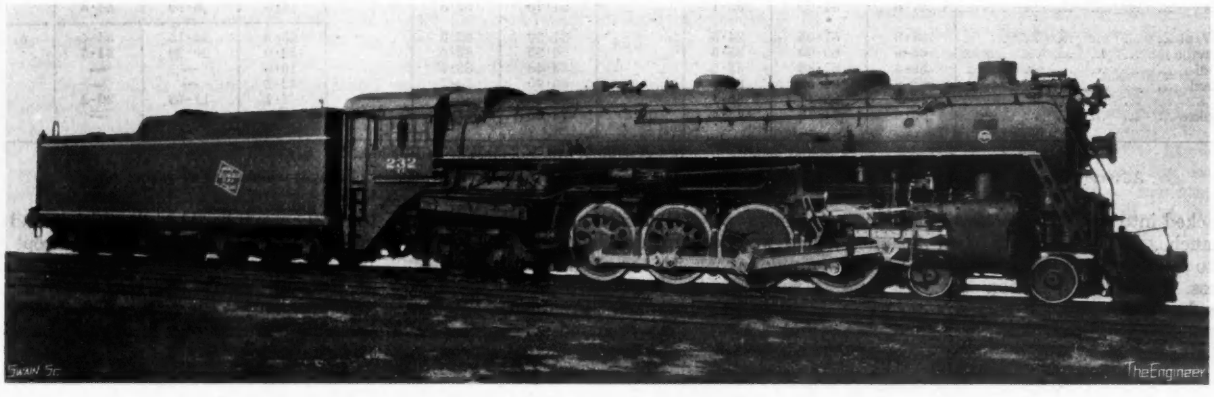


FIG. 3—CHICAGO, MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD 4–8–4 LOCOMOTIVE "S2"

sidings to Union Station. A large proportion of this 3-mile distance is on a falling gradient and the locomotive had to make little more effort than was required to get the train over the level crossing with the Chicago and North Western line to Omaha. It is not uncommon for American trains to be backed into terminal stations in this way for much greater distances than 3 miles, and to attain speeds up to 60 m.p.h. in the process. On this occasion progress was quite decorous and even so the train came alongside its appointed platform at the Union Station, some forty minutes before its departure time of 8.10 a.m., and the engine was left idling throughout this period. This is normal practice and it was denied that it is due to any difficulty in restarting the engine; certainly it started immediately after a momentary stop to demonstrate the point, although starting from cold may not always be quite so easy.

TABLE I.—*Chicago, Milwaukee, St. Paul and Pacific Railroad*

Direction		Down	Down		Up		
Train number		27	27		10		
Number of vehicles		7	7		7		
Approximate tonnage		440	440		440		
Class of locomotive		"F6"	Diesel		"A2"		
Wheel arrangement		4–6–4	0–6–6–0		4–4–2		
Locomotive number		125	21B		3		

Timing point	Miles	Minutes	Speed (m.p.h.)		Minutes	Speed (m.p.h.)		Miles	Minutes	Speed (m.p.h.)	
			Inter.	S. to s.		Inter.	S. to s.			Inter.	S. to s.
Chicago	0	0			0			42·9	40·50	23·2	63·5
Western Avenue	2·9	7·57	28·0		7·83	22·2		40·0	33·0	46·1	
Tower A5	5·4	—			11·33	43·0		38·5	31·05	69·5	
Grayland	8·2	13·70	51·9		14·13	63·0		34·7	27·77	70·6	
Forest Glen	10·2	16·80*	38·8*		18·62*	26·8*		32·7	26·07	90·5	
Morton Grove	14·3	20·67	63·5		22·77	59·8		28·6	23·35	89·8	
Glenview	17·4	23·03	78·8		25·22	76·0		25·5	21·28	86·5	
Deerfield	23·9	28·35	73·3		30·55	73·1		19·0	16·77	91·0	
West Lake Forest	28·0	31·43	79·8		33·50	83·3		14·9	14·07	89·0	
Rondout	32·3	35·05	73·3		36·60	83·3		10·6	11·17	74·2	
Wilson	36·8	39·18	65·5†		40·13	76·5†		6·1	7·53	67·1	
Gurnee	38·6	40·58	77·0		41·47	80·5		4·3	5·92	43·5	
Wadsworth	42·9	43·62	85·0		44·38	88·5		18·9	17·53	62·5	64·5
Russell	47·0	46·70	79·8		47·37	82·3		15·8	14·55	79·2	
Truesdell	52·6	—	—		51·35	84·5		9·2	9·55	78·5	
Somers	57·5	54·00	86·1		54·78	85·8		4·3	5·80	44·5	
Sturtevant	61·8	57·05	84·5		57·90	82·6		23·2	24·15	64·4	57·6
Franksville	66·0	60·00	85·5		60·95	82·6		19·0	20·20	84·5	
Caledonia	69·4	62·38	85·6		63·40	83·3		15·6	—	—	
Oakwood	72·8	64·62	89·5		65·70	88·7		12·2	—	—	
Lake	77·9	68·17	86·1		69·28	85·3		7·1	11·75	36·2	
Milwaukee	85·0	77·78	44·4	65·6	78·85	44·6	64·6	0	0	—	

* Signal delays. † Speed reduced over rail crossing at Rondout.

Adverse gradients up to 1 in 100 occur in the first few miles from Chicago and from Milwaukee; remainder has slight undulations averaging level.

CHICAGO TO MILWAUKEE

When the starting signal sounded in the cab the engineer and fireman verbally confirmed to each other that the position light signal was "clear" and the appropriate remark was made at each signal until we were well into the country on straight track, where the strict letter of the rule was sometimes relaxed. In the vicinity of the Union Station the writer sought in vain for the alleged signals until in reply to a request for information, the fireman drew attention to them on the ground, a position reserved in Great Britain for signals for shunting movements with one or two main-line exceptions in open country.

The actual start, effected by gradual opening of the throttle, was very gentle and was accompanied by an increase in the muffled roar in the engine compartment. Afterwards the locomotive picked up speed rapidly in an apparently effortless manner, and nothing that occurred within the cab was so interesting as the changing view of the road with its signals, junctions and level crossings in the first few miles of the journey. Speed was reduced for the curve at Western Avenue Station, passed at the booked time, and then built up rapidly, with appropriate "changes of gear" until a double-yellow signal was seen ahead, compelling a speed reduction in preparation for a possible stop at a level crossing, over which a Chicago-bound C. and N.W. train had preference. A clear signal was seen 16 min. after the start, during which time some 8½ miles had been covered and the train was 1½ min. behind schedule; full throttle opening was then given and "top gear" was engaged 1½ min. later.

The locomotive was then going "all out" and proceeded to cover the 63·6 miles from Morton Grove to Lake in 46 min 31 sec at an average of 82 m.p.h., although neither the speedometer nor chronograph readings from mileposts showed any maximum appreciably over 90 m.p.h., the specified limit for this and most other passenger trains on the Chicago-Milwaukee line. (The three fastest trains in each direction are allowed to go up to 100 m.p.h.) During this period the controls were left untouched, except that power was cut off over the level rail crossing at Rondout, and on this generally straight and level section the riding of the locomotive was equal to that of a "rough" coach on a British main line.

As the locomotive approaches a clear signal the apparatus in the cab shows a red light that is replaced by green as the signal is passed; red and yellow flashes are given at level road crossings and at junctions, flashes appear with the sounding of a whistle.

At Lake the train was still 17 sec behind time, even this fast running having regained less than 1½ min on schedule, but the timetable allows 11 min for the last 7·1 miles into Milwaukee, whereas 9½ min sufficed and so the arrival was over a minute early despite what appeared (after such high speed) to be a drastic speed reduction to 50 m.p.h. on a bend in the approach to the city and a crawl round sharp curves in the last half mile, with hand signalling at street crossings.

This particular locomotive ("21 B") was known by the enginemen to be not one of

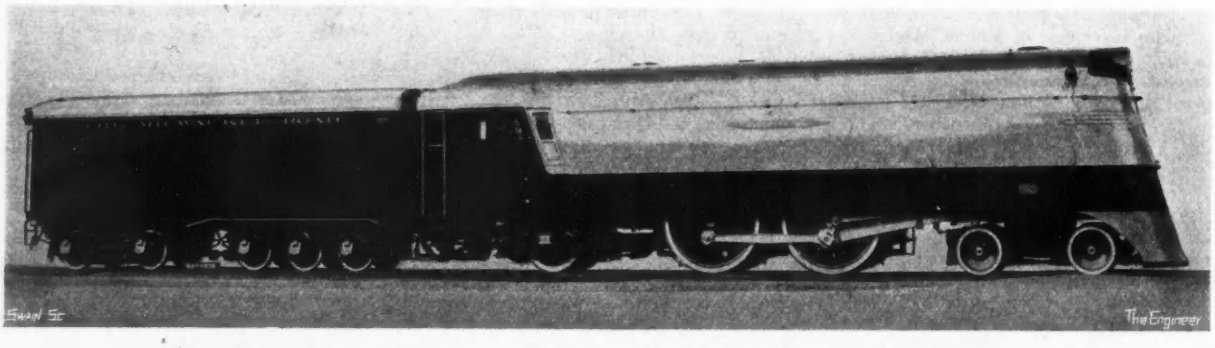


FIG. 4—CHICAGO MILWAUKEE, ST. PAUL AND PACIFIC RAILROAD 4–4–2 LOCOMOTIVE

the best of its class, but it was seen to be capable of maintaining the 80 min schedule of this train with seven vehicles in good weather. On a journey in the opposite direction a time of 73 min 20 sec was recorded on a train of ten vehicles hauled by a two-unit diesel-electric locomotive.

Milwaukee 4–4–2

The first impression gained in the cab of Milwaukee "No. 3," a streamlined 4–4–2, (Fig. 4) half an hour after leaving the diesel-electric "21 B," was of a wide expanse of boiler back-head, gauges and control handles, and a poor view of the track ahead. To anyone standing in the centre of the footplate the view is, in fact, zero, but from either of the seats one can see all that is necessary through a surprisingly small area of front window and the practical advantage of the wide window of a diesel locomotive is less than might at first appear.

This engine is one of a number of 4–4–2s specially built for running the "Hiawatha" trains on fast schedules introduced in 1935, but their use in this service soon became limited because the popularity of the trains made it necessary to lengthen them and to build larger locomotives to handle the heavier loads. The "Atlantics" are oil-fired and this is unusual on locomotives working in the vicinity of Chicago, although oil firing of steam locomotives is an old-established practice on certain sections of American and Canadian railroads.

The boiler pressure gauge is mounted in the centre of the back plate of the boiler and presents a face to the engineer and to the fireman in their normal riding positions. Another gauge shows both the pressure in the steam chests and the pressure (or vacuum) in the blast pipe, although by a printer's error on the card in the gauge on this particular engine, the scale for the former pressure was marked "Steam Heat." There are two boiler water gauges of heavily protected type and, rather unusually, the gauges for tender water and fuel oil are mounted on the back plate of the boiler. A speedometer is a necessary device on a locomotive running on a schedule that demands maximum speeds close to the permissible limit. It was noticed that the throttle opening could be finely adjusted by easy pressure from one hand, a condition in very marked contrast to what is found on some of Britain's largest locomotives.

Footplate work with oil firing is naturally cleaner than when coal is the fuel, but on No. 3 the fireman was much more busily engaged in repeatedly adjusting the fuel supply to match the demand of the cylinders than is normally the case on stoker-fired, coal-burning locomotives. His greatest care was the avoidance of excessive smoke production, and once he allowed a trickle of sand to be drawn through the fire-hole with the object of scouring soot from the tubes.

The locomotive has no cut-off indicator and the recognised method of control is to set throttle-opening and cut-off so as to give an exhaust pressure of about 5 lb per square inch in normal running. The nominal boiler pressure is 300 lb per square inch, but for most of the running time the steam was throttled down to a steam chest pressure of 200 lb per square inch and the exhaust pressure was usually about 5 lb per square inch.

(To be continued)

The French Liner "Liberté"

ON Thursday, August 10th, we were invited by the French Line of 20, Cockspur Street, London, to inspect at Le Havre, the new Atlantic liner "Liberté," which was then completing the extensive reconditioning and redecoration planned by her owners, the Compagnie Generale Transatlantique, at a cost of about £7,000,000, prior to sailing on her maiden voyage on Thursday last, August 17th, from Le Havre to New York via Southampton, thereby inaugurating along with her sister ship, the "Ile de France," a new weekly service to America. The "Liberté" is the third largest liner in the world, and an ex-Blue Riband holder, being the former "Europa" of the North German Lloyd Company.

In the course of her reconditioning an opportunity was taken to overhaul carefully her main and auxiliary propelling machinery and to introduce improvements. It is of interest to record that on her recent official trials she attained a maximum speed of well over 25 knots, a result very satisfactory for her new schedule, especially when it is borne in mind that at the time when she was ordered in 1926 her contract speed was fixed at 25–26 knots.

A Short History of the Liner

The order for the "Europa" was placed by the North German Lloyd Company with the Hamburg firm of Blohm and Voss in December, 1926. In general size and design she was intended to be a sister to the "Bremen," the order for which was placed earlier with the Deschimag Company, of Bremen. The "Europa" was launched in August, 1928, and her building proceeded to plan, until during her fitting out a fire occurred in the ship which delayed her completion. Her official trials took place early in 1930, and on March 25th of that year she sailed from Bremerhaven on her maiden voyage to New York via Southampton and Cherbourg. During that voyage she set up a new record for an Atlantic crossing, by making the voyage from Cherbourg to Ambrose Channel Light Vessel in New York harbour in four days seventeen hours and six minutes, at an average speed of 27·91 knots. On one of the days she covered 704 miles at a speed of 28·16 knots.

During the last war she was laid up at Bremerhaven and suffered from air attacks by the R.A.F., her sister ship the "Bremen," being burnt out.

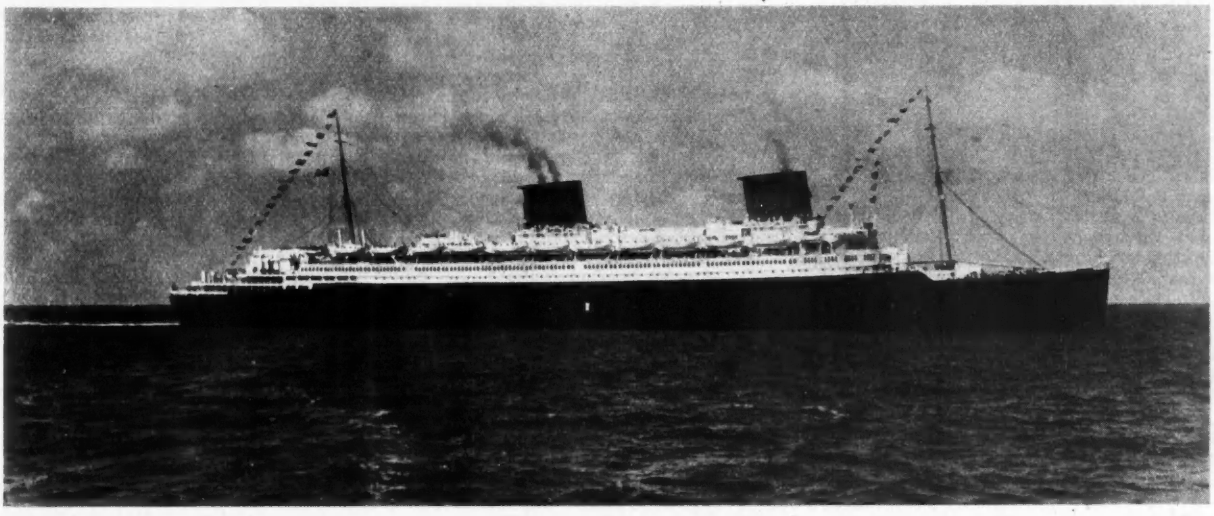
After the war she was handed over to France for reparations and was later transferred to the ownership of the Compagnie General Transatlantique for the service of the French Line.

Whilst at Le Havre awaiting this transfer, with a nucleus crew aboard, on Sunday, December 7, 1946, a heavy gale accompanied by a tidal wave, tore her from her moorings at the Mole. She was swept across the harbour and finally collided with the sunken wreck of the "Paris." A hole some 20ft in length was made in her hull at engine-room level, and she foundered on a mud bank and settled down at an angle of 50 deg. Later the hull was pumped out and she regained an upright position.

At the time of the accident it was intended to prepare her for Atlantic service at once, and had the work gone forward as arranged she would have sailed for New York in April or May of 1947. The damage sustained, however, necessitated extensive reconditioning, particularly of her internal accommodation, and that work was entrusted to the Chantier & Ateliers de Penhoët, Saint Nazaire, a company which has for eighty-five years constructed and engined nearly all of the famous French Line ships, including the "Normandie."

Hull Improvements

In a technical paper presented before the 1946 autumn meeting of the Society of Naval Architects and Marine Engineers, New York, by Messrs. Bates and Wanless, some criticisms of the design and construction of the "Europa" were made. They were deemed somewhat



THE FRENCH LINER "LIBERTE"

extravagant by Mr. D. Arnott, the Vice-President and Chief Surveyor of the American Bureau of Shipping, who was supported in his opinion by Messrs. Stewart and Isherwood. But it was nevertheless decided by the French engineers concerned to strengthen the hull, to improve the sub-division, to fit fire-resisting bulkheads and to redesign the electrical equipment. The measures taken included the strengthening of the promenade deck by doubling plates, 94m in length, 2m wide and 24mm thick, while points at the centre of the ship were also strengthened. Additional strengthening had already been added during 1933 and 1939 by the North German Lloyd when it increased the strength of the angles at the large openings for the turbines and the two large funnel uptakes. Finally, it was decided to increase the stability of the ship and diminish the fatigue of flexure, by disposing 2500 tons of ballast in centre compartments of the ship. These measures, we are informed, have reduced the working stresses in the hull to values approximating to those of the "Normandie," which was considered a strong ship. The bulkheads were increased in height so as to meet the requirements of the 1948 London Convention as far as was reasonable and realisable in practice.

Particular attention was paid to fireproofing, additions being made to the arrangements in existence when the ship was handed over. The "Liberté" is now divided into four distinct and isolated sections for electric current supply by fireproof bulkheads, while each of these sections is again sub-divided by the existing pattern of fireproof bulkheads, which, according to regulations, should be 130ft or less apart. Also, as required by the latest regulations, the cinema projection rooms, the wireless station, the main switchboard, the wheelhouse and the auxiliary generating plants are enclosed by fireproof bulkheads.

There is a central safety station which is manned throughout the twenty-four hours, and in the watchroom, in the forward engine-room and at the central switchboard there are danger indicators giving both visual and sound signals. Audible warning signals can be sent from the central safety station to fifteen places in the ship used by safety teams. In all working compartments, passenger and crew cabins and also the public rooms, there are over 1300 detectors, which instantly indicate at the central safety station any abnormal rise in temperature. On the watchman's rounds there are ninety-two check indicators, while for the cargo spaces there are smoke indicators, and the latest means for extinguishing fires are provided.

Included among the general refitting work we noted that additional cold storage space and also hold compartments fitted for the carriage of uncrated motor-cars have been built in. On the sun deck a light alloy garage has been built for the accommodation of uncrated motor-cars. In all classes of public rooms there has been replanning and rearrangement, and the crew and officers' quarters have been greatly extended and improved to meet the requirements of the Seattle Conference. The general particulars of the hull and passenger accommodation are now as follows :—

Hull Dimensions

Overall length	936ft 9in
Breadth	101ft 8½in
Depth to upper promenade deck	79ft
Number of complete decks	8
Approximate gross tonnage	49,746
Loaded displacement about	57,800 tons
Deadweight carrying capacity	14,000 tons

Passenger Accommodation

First class	569
Cabin class	562
Tourist class	382
Total all classes	1,513

Machinery

Total power	120,000 s.h.p.

The propelling machinery comprises a quadruple-screw arrangement of single-reduction geared Parsons reaction turbines, taking steam from large oil-fired water-tube boilers. There are two electric power stations; in the one aft of the main engine-rooms are three sets of 500kW General Motors multiple-cylinder, medium-speed diesel engine driven generators, while forward in the boiler space a new steam turbine-driven generator room has been constructed containing two groups of Alsthom turbo-dynamos, each of which comprises two generators driven by a steam turbine. These sets were originally built for the French cruiser "Clemenceau," and designed to develop 900kW at 230V. This station occupies the space formerly occupied by four boilers. The two generator sets can be paralleled, and used in various ways at sea or in port through the new central switchboard. All electric cables have been renewed on the twin-pole system, and special converters have been installed to serve the large number of fluorescent lamps used in certain sections of the public rooms.

For emergency purposes two groups of 100kW diesel engine driven generator sets are arranged on the sun deck to supply 230V current to essential circuits. In addition, a 500Ah cadmium-nickel battery has been supplied which, on the failure of the main supply, automatically comes into action to maintain essential services. In order to supply fresh water while at sea, new evaporators in two groups have been installed, with a combined duty of 600 tons of fresh water in twenty-four hours.

The well-designed bridge with the Atlas steam steering gear has been retained, and we noted that additional safety devices have been fitted for navigation. They include two types of high frequency electric depth recorders, a "Decca" radar direction finder, a "Loran" radar direction finder, a "Brown" gyro compass with seven stations, and a similar installation of "Sperry" gyro compasses. There are, in addition, the usual radio and radar sets and powerful searchlights for docking and emergency uses are provided.

FIRST CLASS LIBRARY AND LOUNGE

Public Rooms and Cabin Accommodation

In redesigning and redecorating the "Liberté," a scheme has been followed giving a dignity befitting the service of the ship. Divided uptakes of the boilers permit a clear view through the principal rooms on the promenade deck. The two funnels, which are finished in deep red with black upper bands, have been fitted with rear horizontal fins, which are intended to prevent smoke and fumes from descending on to the upper decks.

On the sun deck first-class passengers have available the Café de L'Atlantique, which is over 70ft long, and is arranged for dancing with an illuminated floor. On the same deck aft is the Chapel, which has accommodation for about seventy worshippers. On the boat deck is the children's playroom, and below on the promenade deck are the principal first-class rooms. The forward room is the Salle de Spectacles, a cinema and theatre, which is fitted with a fine stage and has seating for 373 persons. The lounge library, decorated by Lolou, is a large room, and it leads through a gallery, also decorated by Lolou, to the main lounge amidships. This is decorated by Spade, and has natural lighting from six tall windows on either side. The length of this room is 125ft, with a width of 60ft. At one end is a large doorway with four unframed plate glass doors and the central part is flanked by twelve golden columns Passing through the card and music rooms, which adjoin the grand salon, we reach the first-class smoke room, which is decorated in polished ash with gold-speckled ivory lacquer panels and a large relief panel by Dunand. Aft of this room is a private crescent-shaped bar. The swimming pool has been newly decorated in mosaic work; it is on "F" deck and is adjacent to a well-equipped gymnasium.

The first-class dining-room is on "D" deck and there is also a pleasantly designed children's dining-room. The main room has a length of 110ft and extending the whole width of the ship, the height is 30ft and there is seating at small tables for 491 passengers. A feature of the decoration are four large panels by Marc Simon, depicting Earth, Air, Fire and Water.

Included in the first-class cabin accommodation are four luxury suites on the main deck and twelve such apartments of a less luxurious character on "A" deck. They consist of a double-bed cabin, a sitting-room, which can be transformed into a bedroom, and also a private bathroom. The luxury rooms are named "Algerie," "Provence," "Normandie" and "Alsace," while the semi-luxury rooms are named "Bastin," "La Ciotat," "Avranches," "Caen," "Arromanches" and "Bayoux," "Rouen," "Saint Troupez," "Lorient," "Saint-Nazaire," "Le Havre" and "Royan." The essentially French character of these rooms will, it is felt, appeal to the Atlantic travelling public.

In this necessarily short article we have only touched upon some of the features of this fine, newly reconditioned liner. It only remains to say that we found the passenger and public room accommodation in all three classes of that high standard we have come to associate with French Line ships, and we express the hope that the "Liberté" may for many years play her rightful part in bringing together the peoples of America and Europe.

Mixed Traffic Locomotive for the Estoril Electric Railway

FOR service on the 5ft 6in gauge line from Lisbon to Estoril and Cascais, the General Electric Company, Ltd., has recently supplied a 1500V d.c. mixed traffic locomotive to the Estoril Electric Railway, Portugal. This locomotive was part of an order which also included motor-coaches and trailers for passenger services, and is required for hauling passenger trains of 240 tons or goods trains of 600 tons on the Lisbon-Cascais line at maximum speeds of 50 m.p.h. and 30 m.p.h., respectively.

The continuous and one-hour ratings and the main overall dimensions of the locomotive are tabulated separately herewith.

Locomotive Ratings

	H.P.	Tractive Effort	Speed
		lb.	m.p.h.
Continuous rating full field	840	14,240	21·7
Continuous rating weak field	880	11,840	27·3
One hour rating full field ...	1,080	20,500	19·3
One hour rating weak field	1,120	17,600	23·4

Bogies

As illustrated herewith, the locomotive has the B_o-B_o wheel arrangement, the tractive and braking forces being transmitted through an articulated pin connection between the bogies, which carry the buffers and drawgear. They are coupled together by a universal joint at a centre height from the rails which is 1½in higher than the centre of the buffers. The frames are built of welded steel plates.

Overall Dimensions of Mixed Traffic Locomotive

	Ft.	In.
Gauge	5	5 7/16
Width over body	10	0
Maximum width over handrails	10	7¾
Length over buffers	41	8
Length over body	38	0
Bogie wheelbase	9	0
Distance between bogie centres	19	6
Wheel diameter	3	5½
Height over lowered pantograph	14	9
Height to roof	13	2
Loading per bogie	26 tons	

The weight of the body is supported on side bearers with spherical seats and on end bearers, which are of rubber and provide compensation for weight transfer between the bogies and for vertical movements of the ends of the bogies or of the body. Both side and end bearers are free to slide sideways and have renewable anti-friction liners, which do not require lubrication. Total sideways movement of the bogie centre, under the control of a pair of laminated springs, is 1½in. The rolled steel disc wheels have the tyres integral with the centres and the axleboxes are equipped with oil-lubricated Timken tapered roller bearings. All the wearing faces of the axleboxes and guides are intended to run without lubrication and are faced with manganese steel liners secured by welding. The spring links of the laminated suspension springs each carry an auxiliary rubber damping spring.

All four wheels of each bogie are provided with sanding gear, with two sandboxes for each direction of running, operated by compressed air. The controls in the cabs are arranged so that when the sanding pedal at the forward end of the locomotive is depressed, the rails are sanded from the four boxes, which are ahead of the wheels.

Superstructure

The body is built of thin mild steel sheets, which are welded to light pressed steel section stiffeners, and mounted on rolled steel joist longitudinal strakes. On each side of these strakes, below the floor, are ducts, one carrying the electric cables and the other the cooling air from the blower to the motors in No. 2 bogie. Leather bellows connect the duct to the traction motors in that bogie, the other pair being supplied direct from the blower. The cable duct has doors giving access from above and doors in the floor also give access to the batteries. The roof over the machinery compartment can be removed when repairs to the auxiliaries have to be carried out.

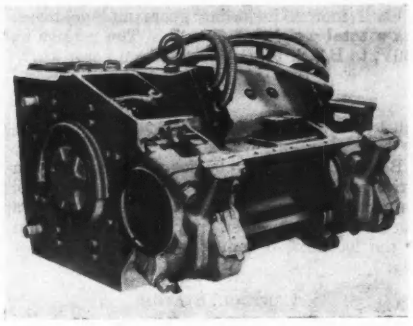
Internally the body is divided into separate compartments for the auxiliary machines, resistances and h.t. apparatus, with a free space in the centre for baggage. The resistances are mounted in banks and access to them is by means of removable panels on three sides—from the baggage compartment, the side corridor and the h.t. compartment.

All the mechanical parts of the locomotive were built by the North British Locomotive Company, Ltd.

Electrical Equipment

Two air-operated pantographs are fitted, each with its own roof-mounted isolating switch. Only one pantograph need be used in normal service, but both may be employed together for working the heaviest loads.

A main isolating switch is provided inside the h.t. compartment, with its operating handles outside in the corridor. When this switch is operated the pantographs are lowered, the 1500V circuits are earthed and the safety locks on the h.t. compartment door are released, giving access from the side corridor.

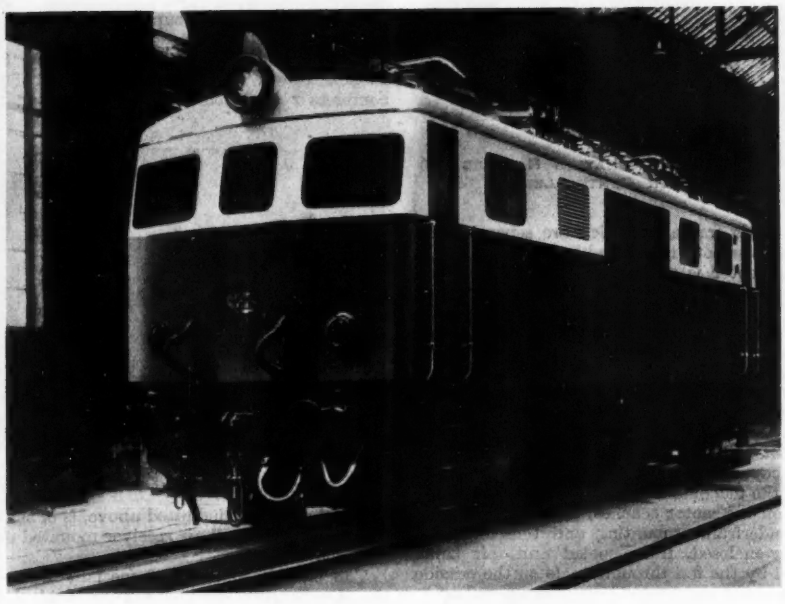


AXLE HUNG TRACTION MOTOR

Two axle-hung traction motors, mounted in each bogie, drive the axles through single-reduction gearing with a ratio of 67 : 16. Forced ventilation is provided by a blower in the machinery compartment, part of the output from which is used for cooling the starting resistances.

The traction motors are in accordance with the latest practice, particularly as regards the insulation, which is designed to withstand high operating temperatures and the severe vibration characteristic of traction service.

The armature is carried on grease-lubricated roller bearings, the bearing at the commutator end being enclosed in a housing in such a manner that the armature can be removed from the shell without opening up the bearings. There is no separate end housing at the commutator end of the motor frame, which permits the use of very rigid brushgear, as developed by the G.E.C. for traction motors. Cooling air, entering the motor through flexible bellows at the commutator end, passes between the field coils and over the armature surface, and also through ducts in the armature core. A small auxiliary



B_o-B_o MIXED TRAFFIC LOCOMOTIVE

INSTRUMENTS AND CONTROLS IN DRIVER'S CAB

fan is provided on the armature to create some ventilation for minimising overheating and allowing the motors to be worked without forced ventilation for short distances in an emergency.

As shown in one of our illustrations, sleeve bearings are used for the motor suspension, oil being fed to the bearings by means of wool packing. The drive from motor to axle is by single-reduction gearing manufactured by Alfred Wiseman and Co., Ltd.; the gears are enclosed in a substantial sheet steel gearcase, designed to be as oil-tight as possible for the restricted space available.

Each motor, including gears and gearcase, has a total weight of 6940 lb. The ratings at 750V, to B.S.S. 173/1941, are given herewith.

Traction Motor Ratings	Continuous h.p.	One-hour h.p.
Full field	210	270
Weak field	220	280

Both motors in each bogie are permanently in series, and control is effected by series or parallel connection of the pairs. Either pair of motors can be isolated in emergency, limited operation of the locomotive being possible on the other two.

Control System

Control is effected by means of electro pneumatic contactors. The first ten notches on the master controller are resistance notches, Full series is reached on notch 11. For transition to parallel the reverse and combination handle is moved from "forward series" to "forward parallel," and the accelerating handle is returned to notch 2, which is located automatically by depressing a button on the end of the handle. Transition then takes place by the shunt method, after which the equipment is notched up to full parallel by advancing the accelerating handle again to notch 11.

Notch 1 on the controller introduces a section of the main resistance, which is used only during starting or light running of the locomotive. Consequently it is not required during acceleration in parallel, in which only nine resistance steps are used. The total of nineteen resistance notches provides for satisfactory handling of widely varied weights of train in different conditions of adhesion.

Two weak-field notches are provided on the accelerating handle quadrant. These may be used both in series and parallel, so that a total of six economical running speeds is available. On the first of these notches a non-inductive diverter resistance is connected across part of the fields. Minimum field is obtained by cutting these sections of the windings out of circuit.

The control switch on the master controller has two "on" positions, one of which is used when working passenger trains and the other for goods traffic. These are associated with emergency braking initiated by release of one of the dead man's treadles. In the "goods" position the opening of the vacuum emergency valve in the train pipe is delayed until the application of the locomotive air brake has begun so that the train is allowed to close up. Two dead man's treadles are provided in each cab.

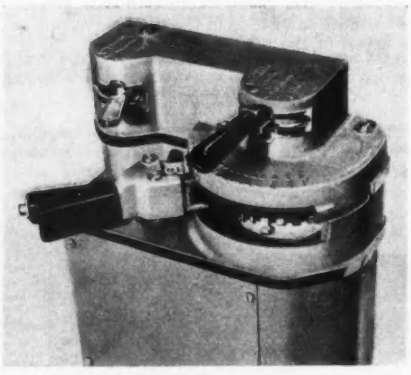
As the main resistance sections are in parallel during parallel operation of the motors, there is an overload relay in each motor circuit, and a third relay in the main trolley line to protect the circuits on the positive side of the motor relays. When any of these relays operates a section of the main resistance is brought into circuit before the line contactors open, to limit the current they have to break.

No-volt protection is provided by means of a system employing a no-current relay, which opens all power circuits in the event of a failure of the traction current. After this relay has operated, the master controller must be returned to "off" before the power circuits can be re-established.

Auxiliary Machines

All the auxiliary machines are housed in a compartment adjacent to No. 1 driver's cab. They comprise a 1500/110V motor generator set for control and lighting supplies; a motor-compressor set supplied by G. D. Peters, Ltd., for the Westinghouse brakes on the locomotive, the electro-pneumatic contactors, pantograph operation, sanding and horn; an exhauster for vacuum braking on the train, and a blower to supply cooling air for the motors and resistances. All these machines operate at 1500V direct current. The blower motor is started by the same contactor as the motor-generator, but the latter can be isolated by a switch in case of emergency, to allow the blower to be operated independently. A 110V battery carried in the underframe, accessible from the baggage compartment, floats across the generator output and supplies all the locomotive lighting when the motor generator set is not running. Supplies for coach lighting are fed from the generator over jumper cables between the vehicles.

The motor generator set is identical with those used on the new motor coaches recently supplied to the Estoril Electric Railway by the G.E.C. and has a d.c. output of 8kW at 110V, to provide for the train lighting in addition to other loads. The set is of the usual traction type, in which the motor and generator are mounted on a common shaft with a bearing at each end, the armature assembly being mounted



Faceplate and Operating Handles of Master Controller

in a single frame, in which are separate field systems for both motor and generator.

The motor is a two-pole compound wound machine, the shunt winding being fed from the 110V supply. The generator has four main poles but no interpoles, the main poles being excited from the 110V output via a voltage regulator. A small field winding in series with the motor armature is fitted to ensure the generator building up with the correct polarity. Class B insulation is used throughout the machine, all light current windings being of glass-covered wire.

As the machine is interchangeable with those used on the motor coaches, it must be suitable for underframe mounting and therefore is a totally-enclosed, frame-cooled unit, air being forced by the fan through ducts on the outside of the shell, which is ribbed to assist cooling.

The Westinghouse type 4V110 exhauster is driven by a 1500V two-pole series motor, continuously rated at 3 h.p., 600 r.p.m., with an intermittent rating of 6 h.p. at 1200 r.p.m. The higher speed is obtained by one step of field weakening effected by means of a tap and is used when releasing the brakes. As this machine also is interchangeable with those on the motor coaches, it is totally enclosed so as to be suitable for under-frame mounting.

The Keith Blackman type 21 blower is driven by a two-pole, self-ventilated series motor, rated at 8 h.p., at 1250 r.p.m., and supplies cooling air to the four traction motors and the resistance compartment.

In the cabs, as illustrated on page 177, all the instruments are grouped in a desk form of structure at the front, with the master controller and brake controls to right and left, respectively, of the driver's tip-up seat. The controls are arranged for easy manipulation when seated or standing. The cab equipment includes electric windscreen wipers and speedometers as well as the usual meters.

Braking System

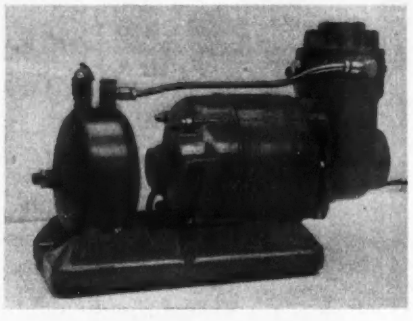
The brake equipment was supplied by the Westinghouse Brake and Signal Company, Ltd. On the locomotive the brakes are applied by compressed air but since the coaching stock is vacuum-braked, the locomotive is fitted to maintain and apply both brakes, as required. When running light or hauling unbraked stock, the driver applies the air brake only, but when coupled to vacuum-braked coaches the driver's vacuum brake-valve is used. An application of the brake through this valve automatically applies the brakes on the locomotive through the action of a vacuum-operated air proportional application valve.

The locomotive brakes can be applied or released independently even when the locomotive is coupled to vacuum-braked coaches. This operation is accomplished by electrical contacts on the driver's air brake valve, which complete a circuit when a trigger on the handle is depressed, energising a brake cylinder cut-out magnet valve. The trigger can be operated in any position of the brake valve handle and permits the driver to release the locomotive brake when the train brake is applied, or to make gradual, independent applications.

A hand parking brake in each cab applies the brake on the adjacent bogie. The brake rigging is fully articulated and of the clasp type, with two brake blocks for each wheel and two brake cylinders on each bogie.

Small Diaphragm Compressor

A small diaphragm compressor, designed to supply air at up to 30 lb per square inch, is now being made by the Hymatic Engineering Company, Ltd., of Redditch. This new unit, which is intended for supplying air free from oil for a variety of purposes, is made in two models, each driven by a ½ h.p. motor. One model, known as the D.P.6, consists of the compressor mounted on the motor, and the



Small Diaphragm Compressor

other, the D.P.7, illustrated above, is of similar design, with a small air receiver mounted on a common bed plate.

The electric motors are specially built for the compressors and have very rigid shafts with large main bearings. These bearings, together with the big-end bearing on the compressor connecting rod, are grease-packed and are designed to last the life of the machine without need for attention. The compressor crankcase and cylinder are of aluminium alloy and the head is finned to provide an effective cooling surface. An activated carbon filter is fitted to the air intake to remove any traces of smoke or fumes and provide a safeguard to the purity of the air supply.

Competition in Craftsmanship and Draughtsmanship.—In conjunction with the Gauge and Tool Exhibition next May, the Gauge and Toolmakers' Association proposes holding a competition in craftsmanship and draughtmanship for apprentices and learners attached to member firms. A panel of experts will be set up to adjudicate the entries, which, if of a sufficiently high standard, will be on general view during the period of the exhibition, May 15 to 25, 1951.

A 132kV, Three-Core Pipe-Line Compression Cable

A 3250-YARD length of 132kV, three-core, S.L. pipe-line compression cable is being laid a few miles outside Bedford and, at the invitation of the makers, Enfield Cables, Ltd., we recently paid a visit to the site to see something of the installation and jointing.

The main particulars of the cable are tabulated below, and one of our illustrations shows the general arrangement of the three cores in relation to the pipe. Briefly, each of the stranded, paper-insulated conductors is lapped with perforated metal foil, surrounded by lead sheath which acts as a diaphragm subjected to external pressure by the nitrogen inside the steel pipe-line. The lead sheath is reinforced by brass tape, with a protective covering of varnish-impregnated cambric tape. Each made-up core is of slightly oval cross section.

132kV, Three-Core S.L. Pipe-Line Compression Cable at Bedford

Length	3250 yd
Size of conductor	0·25 sq in
Dielectric thickness	0·46in
Dielectric stress (max.)	110kV/cm
Thickness of diaphragm lead sheath	0·08in
External diameter of steel tube ...	5½in
Tube thickness (protected against corrosion)...	7 W.G.—0·176in
Depth of laying	2ft 6in
Nitrogen gas pressure (nominal) ...	200 lb/in²
Electrical loading per circuit	85MVA

To make up the pipe-line, random lengths of 25ft to 40ft of steel tube supplied by Stewarts and Lloyds, Ltd., are butt welded on site to form a continuous tube between joint bays which are spaced to suit the cable length, normally 250 yards in this instance. Protection against corrosion of the pipe-line is provided by a serving of bituminised asbestos which is specified to withstand extremes of operating temperature, without melting due to heat or cracking due to cold.

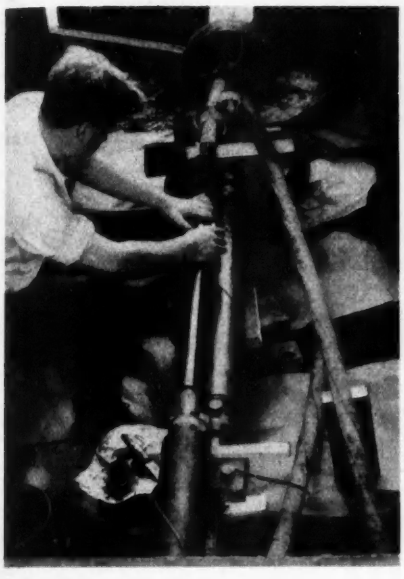
Conventional methods, with but minor modifications, are used for pulling the cable into the pipe-line. The three cores are laid up on the drum with a temporary outer covering of hessian, which is removed as the cable is paid out. To reduce friction during the operation of pulling-in, a lubricant of petroleum jelly/grease is applied to the cable as it enters the tube. Frictional resistance is still further reduced by the fact that in this particular installation copper skid wires of D-shaped cross section are laid up with each core, so that the inside of the pipe-line makes contact with the skid wires instead of the fabric serving. In practice, however, it is claimed that the skid wires can be dispensed with, as in the cable shown in our first illustration.

In the Bedford installation manual winding is used for pulling in the cable, the pull being applied through an American eye to the three stranded cores and the skid wires.

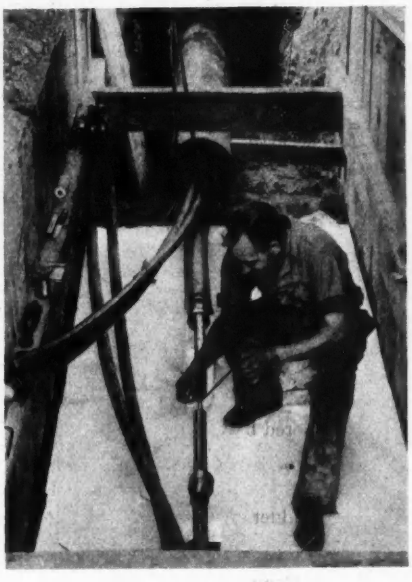
The jointing technique follows well-established lines, as suggested by the accompanying illustrations. Briefly, the conductors are joined with a sweated flush ferrule, the insulation being pencilled down and remade with hand-applied paper tapes to give a 50 per cent increase in radial thickness of insulation at the joint. A fluted copper sleeve is drawn over each completed joint to form a flexible casing which allows the cable to "breathe." The three jointed cores in their copper casings are then enclosed by drawing over a steel sleeve and welding it to the pipe-line at both ends.

Single-wall stabilised-glazed porcelains are used for the cable terminations. They are capable of withstanding the full oil pressure of 200 lb per square inch, which is maintained through the medium of a compensator equipment. A trifurcating box is used for jointing single-core compression cable tails to the three-core cable.

The complete pipe-line is intended to form a gas-filled, gas-tight enclosure and no provision is made for automatically feeding gas into the system to compensate for leakage. Any gas loss that may occur can be made up simply by connecting a cylinder to the inlet valve. Gauges fitted with electrical contacts ensure that warning is given of any variation of gas pressure beyond specified limits.

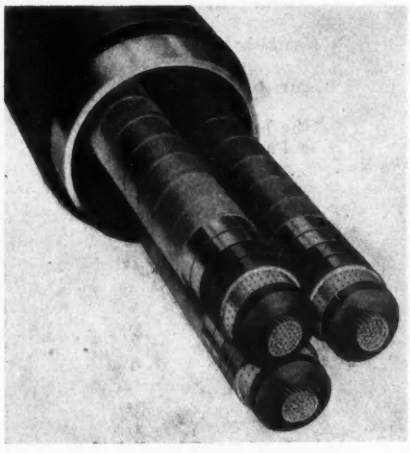


BUILDING UP JOINT INSULATION



FINISHING THE FERRULE

COMPLETED JOINT



132kV COMPRESSION CABLE

British Standards Institution

All British Standard Specifications can be obtained from the Publications Department of the Institution at 28, Victoria Street, London, S.W.1.

STEEL FILLER RODS FOR GAS WELDING OF MILD STEEL

No. 1453 : 1950. This standard covers rods for applications in which a minimum butt weld strength of 28 tons per square inch is required and supersedes a tentative specification produced as Appendix A to B.S. 693 : 1940. It does not cover steel rods for general welding purposes.

The rod is specified in terms of chemical composition and emphasis is laid on the ratio of the carbon to manganese. Other clauses deal with size and tolerances, condition of supply and provision is made for the issue of a certificate of compliance with the specification. Price 1s. post free.

ANALYSIS OF OILS AND FATS

No. 684 : 1950. The first revision of B.S. 684 as published in 1936 has just been issued by the British Standards Institution. The methods contained in the original B.S. 684 were the English translation of the French text of methods prepared by the International Commission for the Study of Fats, and were published to assist in promoting uniformity amongst nations in regard to the analysis of fats. In recent years advances have been made particularly in Great Britain, not only in methods of expression, but in getting a greater measure of agreement on how far standardisation should go, and in what direction it is necessary. The developments in these years have led to the suggestion that the British methods in their latest form should themselves be corrected and published as the revised edition of B.S. 684. The British methods were considered by the International Commission for the Study of Fats in preparing the third edition of the internationally agreed methods (1948), the English translations of which are included in the revision of B.S. 684. It is recognised that, even so, B.S. 684 does not provide a complete set of methods for the analysis of oils and fats, and it is hoped shortly to publish a separate document covering further methods which have so far not been standardised. Price 7s. 6d.

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NOTICE TO READERS

All letters intended for insertion in THE ENGINEER *or containing questions should be accompanied by the name and address of the writer, not necessarily for publication, but as a proof of good faith. No notice whatever can be taken of anonymous communications.*

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SKILLED MEN IN THE FIGHTING SERVICES

In spite of the hostile activities of Communists in Greece, Persia, Indo-China, China and Malaya, the Labour Government since the war has until now concentrated on bringing about economic recovery and the promotion of welfare schemes, while maintaining only just sufficient armed Forces to meet our commitments in Europe and in the Middle and Far East. In striving after both these aims it has achieved a large measure of success as the result of the world demand for goods and services, and the introduction of conscription to maintain the Army and Royal Air Force at the required numerical strength. But while frequently expressing its desire to increase the size of our regular forces, the Government has shown little determination to do so. It has ignored during the past two years the warnings of ex-Service members of Parliament of both Houses, who have consistently maintained that the pay of skilled men in the armed Forces must bear comparison with earnings in civilian life. It cannot be too strongly emphasised in this connection that the long-service regular is not only the backbone of a fighting service from the points of view of tradition and discipline, but under modern conditions he alone can provide the specialised trade skill which is needed. All three fighting services are now alarmingly short of skilled personnel. The Navy, it is true, has all the young regular recruits it requires, but far too many of them take up their option of leaving after seven years (special service engagement) or twelve years (continuous service), instead of re-engaging for pension, which would bring their total period of service up to twenty-two years from the age of eighteen. From the evidence supplied to the Select Committee on Estimates, only 25 per cent of the skilled ratings who completed their first continuous service engagement of twelve years in the Navy since 1945 have re-engaged for pension. The Air Force is in the same predicament, more than 70 per cent of the skilled ratings who completed engagements of up to twelve years in 1949 having left the Service. The Army authorities were unable to produce overall figures for the information of the Committee—perhaps because they would have had an even worse tale to tell—but gave, as an instance, the present wastage of armament artificers after a five or seven-year engagement as 30 per cent.

The failure of the higher grades of regular tradesmen to re-engage is occurring at precisely the time when their knowledge and experience have made them indispensable to their Service, and it has become obvious to the Government that our armed Forces, even at their present reduced strength, cannot continue to function as efficient organisations if the present wastage is allowed to go on. The results of a comprehensive inquiry into pay and conditions in the Services are now being considered by the Cabinet, and the Air Ministry has already announced a new scheme providing for a long-service career up to the age of fifty-five for skilled air crews and a new ladder of advancement based on trade skill and experience instead of, as in the past, on powers of leadership and command. The Communist aggression in Korea appears also to have influenced the Government at last to "get a move on." For the Minister of Defence, in his frank and able speech when opening the debate on defence before the parliamentary summer recess, admitted "the clear need for improvement in the special rates for certain trade skills and flying duty," and he has spoken even more emphatically on this subject in his public speeches since the debate. At the same time, Mr. Shinwell laid stress on the complications likely to arise in any wholescale revision of the existing system of pay and allowances and added that the highly skilled men whom the Services are trying to attract such as men engaged on supersonic equipment—are earning in civilian life as much as £16 to £20 a week. Those, however, are exceptional cases, requiring special treatment. A great deal might be done by substituting civilians for service ratings in establishments where highly skilled maintenance personnel are required, a practice already followed in some aircraft storage depots and in fighting vehicles research establishments. The Air Ministry, indeed, intends to staff all its aircraft storage depots with civilians and is already well on its way to achieving this aim. Naval dockyards are, of course, entirely operated by civilian labour and the Admiralty also proposes to extend the use of civilians to other naval establishments. But the main problem still remains—to ensure that the pay and allowances of tradesmen in the Services are, at least broadly, equal to the earnings they would receive in civilian life. It is reasonable, as an example, to compare the earnings of a chief petty officer, artificer, second class—a very skilled and experienced rating, who would be at the end of his first period of continuous service engagement—with those of a capable and keen fitter on piecework in an engineering works in the Midlands. Including the small increases in pay granted to men of the Services at the end of 1948, the chief petty officer Artificer, second class, earns £5 5s. a week (which includes trade allowance and increments), as compared with £9 a week or more earned by a fitter who is rather above the average in ability and takes a pride in his work. Marriage allowance (children come under the Family Allowances Act) gives the artificer another £2 10s. a week, but this cannot be regarded in any way as "payment for the job." He regards it, rather, as some help towards the cost of the upkeep of an establishment, from which his unmarried colleague living and working alongside him is entirely free, and certainly not as an inducement to remain on in the Service. Nor are matters improved by the gratuity of £100 which he receives if and when he decides to leave at the end of twelve years. The only effective argument which can be advanced against his natural inclination at the age of thirty to live permanently ashore with his wife and family is the prospect of a pension after a further ten years' service. In the case of a chief petty officer or staff sergeant (with five years' service as a corporal and twelve years as a sergeant), this pension amounts to £1 14s. a week. But since a man can continue working ashore nowadays with great profit to himself, until he is sixty-five or over and then receives a National Insurance pension of £2 2s. a week, the argument has no longer the force it used to have.

Admittedly the re-engagement problem is not wholly dependent on pay. There are, as Mr. Shinwell pointed out, the natural attractions of living ashore and the objection to the changes and chances of Service life. Lack of married quarters and inferior barracks accommodation are also serious drawbacks, but the Government, to its credit, has done, and is doing, a great deal to improve matters in those respects. Moreover, men are likely to stay on longer in the Services if the technical skills which they acquire are universally recognised when they return to civilian life. It is thus very important that the Service and civilian courses for apprentices should be standardised as far as possible. Broadly speaking, however, the solution to this urgent problem seems to us to lie in a substantial increase in pay; in prolonging the term of service so as to offer a career which does not finish at forty (a proposal recently adopted by the Air Force); and in offering a man a job ashore after long and faithful service.

PRIDE IN WORK

In reading the lives of engineers of the past who rose from very humble beginnings to important and influential posts, the reader cannot fail to be impressed with the fact that each of them took a real pride in his work, and also endeavoured to produce something that was not only efficient, but also pleasing to the eye. When Patrick Stirling designed for the then Great Northern Railway his celebrated 8ft single-driver express locomotive, a machine that was

highly efficient in its day, he also considered its appearance and had no external pipes or disfigurements, although he skilfully contrived to keep all that was necessary accessible, with the result that the finished product had an immediate appeal—old-fashioned to the modern eye, undoubtedly, but in its day the acme of simple grandeur. The pride of the designer was transmitted all down the line, and both engine driver and stoker would have been ashamed if its bright green livery had been covered in grime, or if the handsome brass safety valve casing had been anything but glistening. Even the goods engines were resplendent in the same colours as their more exalted sisters; indeed, nowadays we should rub our eyes and wonder if we were dreaming should we see such locomotives at work. In the general engineering works the same pride in one's work was very apparent, and mechanic vied with mechanic to turn out the best product of the shop. Some of us who are older can recall the pride with which in our apprenticeship days we were allowed to erect an engine or dynamo, and stamp our initials on the crankshaft or armature shaft. If we have to a large extent lost this pride in our work, what is the cause? Can it be encouraged to return?

Probably one of the chief reasons for the change is to be found in an increase in the size of organisations. When the Great Northern Railway was effectively competing with the Midland and the London and North-Western Railways for the London–Manchester traffic all were kept on their toes, and each took a pride in his own railway. Then came the grouping with less competition, and finally nationalisation with competition between railways eliminated. May not this change contribute to a loss of interest on the part of all concerned? In the factory mass production has come to stay, and with it the making of each operator a specialist, but in a very limited sphere, resulting in what is nearly equivalent to converting the man or woman into a machine. But man is *not* a machine, each man has his own individualities and peculiarities, and if he is treated as a machine he will soon lose all pride in his work and will cease even to be interested. Going a stage higher up the scale the foreman is no longer "monarch of all he surveys"; with functional organisation his duties are apparently more circumscribed, a sense of frustration is sometimes engendered and he can no longer take the same pride in his output, for he feels that others will claim their share. He no longer sees the managing director and has little or no conception of the nature of the competitition that has to be met if the order books are to be kept full. He feels he is but a cog in a gigantic and soulless machine, and himself concentrates on interests outside his daily vocation. It must be conceded that we cannot expect a return to former days, and if pride in work is to return, definite steps must be taken with this in view, and though there is no royal road to success, a few suggestions might give an avenue of approach.

To begin with, everyone must learn the value of his work in the co-ordinated whole. A workman can be shown the individual part on which he is employed in the completed machine and learn how necessary it is, and to what a fine machine he is contributing a part. But why keep indefinitely on one part? By a frequent change round, each time with an explanation as to how the new piece fits into the whole, interest may be gradually awakened. When the firm's products are displayed at Olympia or other centres it is an excellent plan to afford all the opportunity of visiting the exhibition, and comparing the firm's products with those of other makers of similar goods. This all helps to engender a desire that the firm's goods should be the best on the market. Again, if a source of trouble lies in the wide gap between the managing director and the man on the shop floor, much can be done by arranging social functions from time to time in which the lower and upper staff meet for the time being on a level footing, thereby fostering mutual confidence. It is felt that the solution of the whole problem lies in a human approach, and in making every man feel that he is a man and not a machine, that his work has a particular value, and that if he is to take a pride in the finished product of the company—which still is often the case—he must take a pride in producing that for which he is responsible in such a way that he feels no one could better it. Then let us all, whether in the office or in the works, do our part in such a way that not only can we be justifiably proud of what we do, but in a wider way, in what the company can accomplish, and finally be proud in the knowledge that our country need fear no competitor.

Letters to the Editor

(We do not hold ourselves responsible for the opinions of our correspondents)

RAILWAY RECORD RUNS

SIR,—Mr. Livesay is being less than fair to the G.W.R. "City of Truro," in comparing her claim to fame with those of the American "records" he cites. After all, "City of Truro's" speeds were clocked by the late Mr. Charles Rous-Marten for five consecutive quarter-miles up to the final disputed reading.

As it is now a long time since "City of Truro's" performance, it would be as well to recall the facts. During 1904 the G.W.R. ran a series of special trains for the conveyance of the Ocean Mail from Plymouth to Paddington, which frankly set out to do the journey in the shortest time. The best run was on May 9, 1904, and while hauling this to Bristol, "City of Truro" was timed down the Wellington Bank for five consecutive quarter-miles, the times being 10·0, 9·8, 9·4, 9·2 and 8·8 seconds, the last representing 102·3 m.p.h. Immediately after the last reading there had to be a quick shut-down as some platelayers were dawdling on the track.

Mr. Rous-Marten was a very well-known and very experienced train-timer and during his lifetime his accuracy was never questioned. I believe the chief criticism of the timing was the uneven acceleration shown, but that can only be an opinion. In real life things have a habit of not being quite as tidy as theory would indicate. Undoubtedly the acceleration was quite high down the bank and I submit it is logical to assume that the speed was still rising when the shut-down took place, as it is inconceivable that the optimum speed was reached at the precise moment when the platelayers stepped on the track. The class of locomotive had the reputation at that time of being the fastest in the country. It was not until 1906 that Mr. Rous-Marten disclosed the figures and at that time he stated that other timings of 9·4 and 9·2 seconds per quarter had been recorded by him with G.W.R. "Cities" and "Atbaras," and that on other railways he had not recorded anything approaching these speeds. Apart from these very high speeds, the G.W.R. "Cities," "Atbaras," and "Badmintons" (all the same machinery) had been noted on numerous occasions as having exceeded 90 m.p.h.

C. M. KEILLER, M.I.Mech.E.

The Dust Danger in Coal Mines

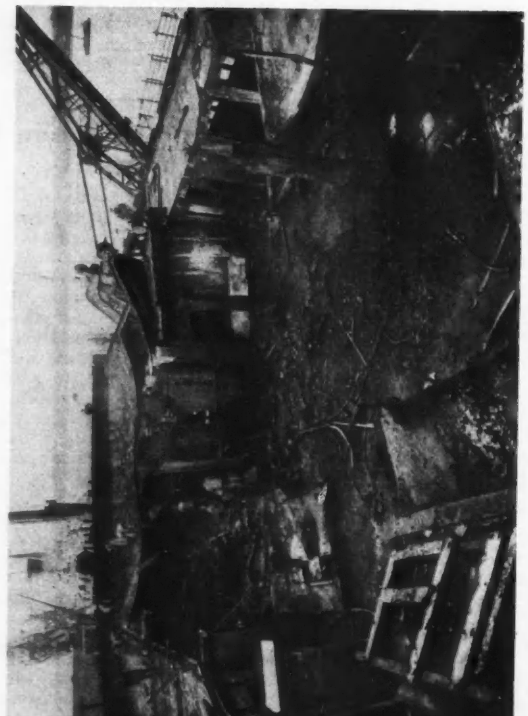
WHEN opening the Safety in Coal Mining exhibition at the Royal Scottish Museum, Edinburgh, recently, Sir Andrew Bryan, the Chief Inspector of Mines, said that the health side was becoming more important than the question of safety of mines. More lives, he said, were being lost by the disease of pneumoconiosis than by accidents, and the solution did not lie with the scientist or doctor, but with the mining engineer. The way to get rid of the disease was by eliminating air-borne dust and, although it was not easy, a great deal more could be done to reduce the amount of dust which was air-borne in British mines. The introduction of coal-cutting machines was a step in the right direction, as they ought to cut down the number of shots fired in coal-getting. Sir Andrew considered that more shots than were necessary were being fired, and paradoxically the only people who were really anxious to get the shot firing question put right were the manufacturers themselves, who wanted to see shots used correctly. He appealed to managers and men in the mines alike to tackle the question. In discussing accidents in mines Sir Andrew pointed out that Scotland was fifth of the seven National Coal Board divisions in the number of persons killed and third in the accident rate in mines. He recalled that from 1900 to 1920 some 1200 miners were killed each year and in 1949 there were 460 killed—the lowest figure recorded and the lowest fatal accident rate of all the coal-producing countries in the world.

Suez Canal Traffic

IN the annual survey of the Suez Canal traffic for 1949 it is revealed that ship movements reached a peak figure, being double the 1938 returns and greater than for 1948. Last year there were 10,420 transit passages totalling 68,862,000 net tons of shipping, compared with 6171 transits totalling 34,418,000 net tons in 1938 and the corresponding returns for 1948 of 8686 transits, totalling 55,081,000 net tons. An analysis of the distribution of the net tonnage between the principal maritime countries showed that Great Britain's pre-war share of 50 per cent had continued to shrink, dropping from 37·6 per cent in 1948 to 36·1 per cent last year. The world increase in the numbers of oil tankers is reflected in the transit figures for this class of ship, there being an increase of 8,039,000 tons of oil cargoes in the south-north direction over 1948, Norway making the biggest contribution. Almost as a corollary to the increase in the movement in oil cargoes is the expansion of the tonnage in ballast. It was especially noticeable in the north-south direction. The survey quotes the amounts of various commodities, such as cereals, metal goods, cement, salt and raw cotton, which passed in each direction, and allocates the proportions of these tonnages to specified areas, giving plus and minus differences compared with 1948 and commenting upon the possible reasons for the shipping trends.

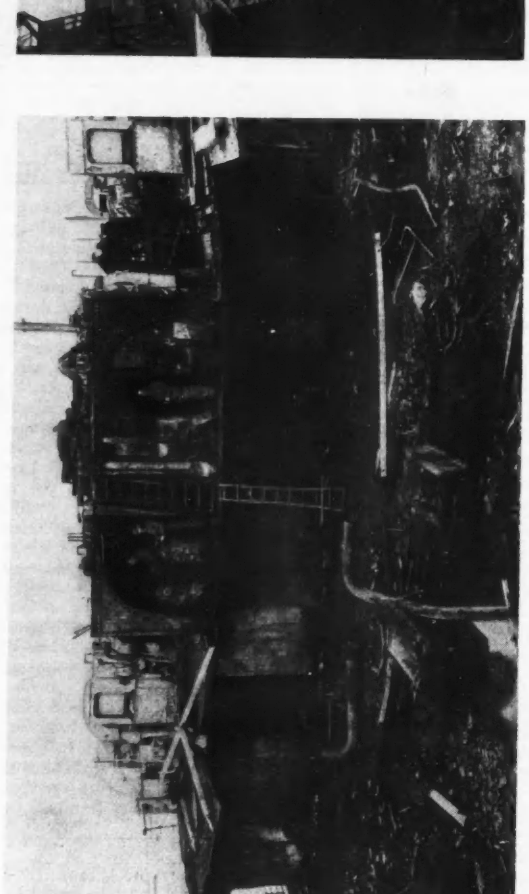
HEAT-TREATMENT OF ALUMINIUM ALLOY CASTINGS.—A data sheet has been issued by Alar, Ltd., listing the heat-treatment conditions for all heat-treatable alloys included in B.S. 1490. It includes notes on recommended practice, the heat-treatment of pressure die castings and stabilising or stress-relieving. The publication is obtainable free of charge from Alar, Ltd., 3, Albemarle Street, London, W.1.

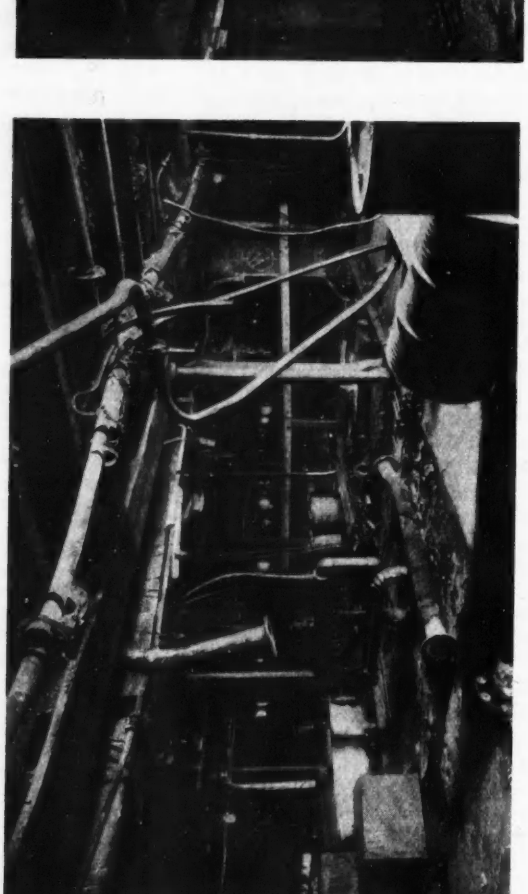
"MONARCH OF BERMUDA" (NOW "NEW AUSTRALIA")
DAMAGE BY FIRE



"A" DECK

"B" DECK





Turbo-Electric Liner "New Australia"

THE "New Australia," which now augments the emigrant service between Britain and Australia, is the ex-Furness Withy quadruple-screw, turbo-electric liner, the "Monarch of Bermuda," which was built in 1931 by Vickers-Armstrongs, Ltd., at the Naval Yard, Walker, engined in conjunction with the General Electric Company, Ltd., and described in THE ENGINEER in our issues dated November 27, December 4 and 11, 1931. The vessel was employed on the New York to Bermuda service and served as a troopship during the war.

During reconversion on the Tyne in preparation for returning to the New York-Bermuda run, after her wartime service, the whole of the passenger decks were completely gutted by fire. The ship was then towed to the Firth of Forth. Some idea of the severity of the damage can be obtained from our illustration of "A" and "B" decks. After careful examination, it was decided that the machinery and part of the hull could be saved and John I. Thornycroft and Co., Ltd., were entrusted with this major reconstruction job under the general supervision of the Shaw, Savill and Albion Company, Ltd., this company acting as managers of the vessel for the British and Australian Governments. A more detailed survey of the hull, carried out at Southampton, whither the ship was able to sail under her own power, revealed that due to corrosive attack, more steelwork would have to be removed than at first anticipated. The combination of fire and wastage entailed cutting away a large proportion of the structure from the bridge deck down to "E" deck, and the fairing of shell, frames and beams, incidental to this work has been the renewal or repair of sidelights and the overhaul of watertight doors. The renewal of plating, beams and frames involved the use of nearly 3000 tons of steel, a figure which gives some idea of the magnitude of the work. The forecastle and quarter decks have been retained but elsewhere the decks have been relaid with Douglas fir and Columbian pine.

Dimensions and Particulars

Length overall	579ft 6in
Length between perpendiculars	550ft
Breadth moulded	76ft 6in
Breadth extreme	83ft 6in
Depth moulded to "B" deck ...	43ft 3in
Gross tonnage	20,256 tons
Service speed	18 knots approx.

Propelling Machinery

Type	Quadruple screw, G.E.C. turbo-electric
Maximum power	19,000 s.h.p.
Number of turbo alternators ...	Two three-phase
Rated output of each alternator	7,500kW
Rated output of each turbine ...	10,000 s.h.p.
Speed of sets	3,000 r.p.m.
Number of propelling motors	Four three-phase synchronous design
Designed continuous output ...	4,750 b.h.p.
Propeller speed	150 r.p.m.
Boilers	Eight Babcock and Wilcox water-tube
Steam pressure	400 lb per square inch gauge
Steam supply turbine stop valve	350 lb per square inch gauge, 600–650 deg. Fah.
Total generating surface ...	42,260 square feet
Total superheater surface ...	17,840 square feet
Total air heater surface	21,120 square feet

Electrical Machinery

Type of generators	Four G.E.C.-Fraser and Chalmers geared
Rating	750kW, 220V d.c.
Rated output of each turbine ...	1,000 h.p.
Speed of turbines	6,000 r.p.m.
Speed of generators	750 r.p.m.

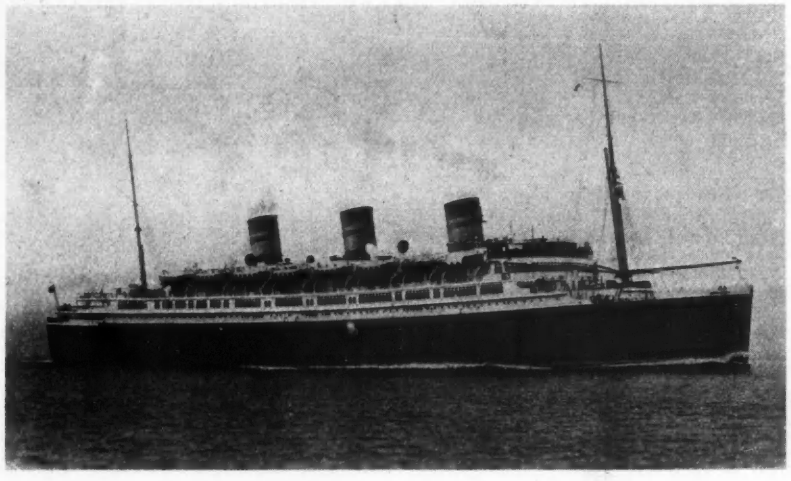
Neither externally nor internally does the new emigrant ship resemble its former self, as can be seen from the accompanying illustrations of the ship as built and as reconstructed. The familiar three funnels have been replaced by two funnels; one large funnel placed about amidships, with a forward funnel constructed in a dipod form and surmounted by a topmast to give the ship an unusual profile. The after funnel, of streamline shape, incorporates a special cravat top developed by Messrs. Thornycroft to solve the problem of keeping the decks clear of smoke and grit. The after mast has been completely removed and the foremast cut down to just above the shrouds. The original long, enclosed promenade deck is now open and one complete deck has not been replaced, resulting in the boats and davits being lowered one deck height. This reduction in top weight, together with the new position of the boats, will have the effect of increasing the initial stability of the ship.

Accommodation

The accommodation has been designed to take 1600 passengers and the majority of cabins are of six-berth size but there is a small number having four berths and eight berths. The cabins are on "D" deck, "B" deck aft, and on "A" deck, while the crew are accommodated in one, two, four and six-berth cabins forward on "D" deck, "C" deck and "B" deck. The engineers are housed on the port side of "A" deck aft and the navigating officers are in a house on the boat deck. The passenger cabins are fitted with two-tier metal berths and the more usual fittings to a simple specification, which does not include the provision of washbasins, thus gaining considerable space in the cabins and increasing the comfort of the passengers. Instead ample communal facilities have been provided in a series of washplaces along the centre-line, which are fitted with washbasins, showers and baths. In addition equipment has been installed for washing clothes and there are also available a number of drying and ironing rooms.

The promenade deck is given over to the public rooms and the open spaces at the sides are laid out for deck games. In a separate house right forward there is a large entrance hall, giving access to a comfortably furnished reading room, housing a comprehensive library, and aft of this hall to port and starboard are hairdressing saloons. Aft of the forward house there is a cross passage from which lobbies lead to a large smoke room provided with a bar. Double doors to port and starboard of the funnel uptake open on to the main entrance hall, in which is a small shopping centre. Continuing aft there is a space which serves several purposes; it is furnished as a general lounge to seat over 300 passengers, and is equipped with a projection room so that the space can be converted to a cinema, additional tubular seating being provided to increase the capacity to over 400. Church services are also to be held in this room, an altar being fitted behind the cinema screen. Right aft is a spacious verandah cafe, decorated with four paintings of Australian landscapes, and large folding doors open on to a sheltered dancing space. Almost immediately above, on the boat deck, is a children's playroom, in which are a number of toys for their entertainment. The main dining saloon is on "C" deck aft of the foyer and forward of the galley, and extends the full width of the ship, with seating for 544; immediately aft of the galley is a smaller dining saloon, taking 174. There are two small dining rooms for children, which are situated one to port and one to starboard of the foyer, seating a total of ninety-four. The swimming pool, on "F" deck, which was a feature in the original vessel, has been retained and partially reconstructed so providing an additional amenity.

Throughout the ship numerous ladderways give access from deck to deck, but the principal means of access is by the series of roomy foyers linked by stairways to port and starboard, and also a lift. The foyer on "B" deck serves as the embarkation entrance and here are situated the purser's bureau and steward's offices. Extensive use of Australian veneers, such as eucalyptus, Queensland maple, silky oak and walnut has been made for panelling the public rooms, and other woods, which have been employed for decorative purposes, include Lebanon cedar, African cherry, beech and weathered sycamore.



"MONARCH OF BERMUDA" AS BUILT IN 1931

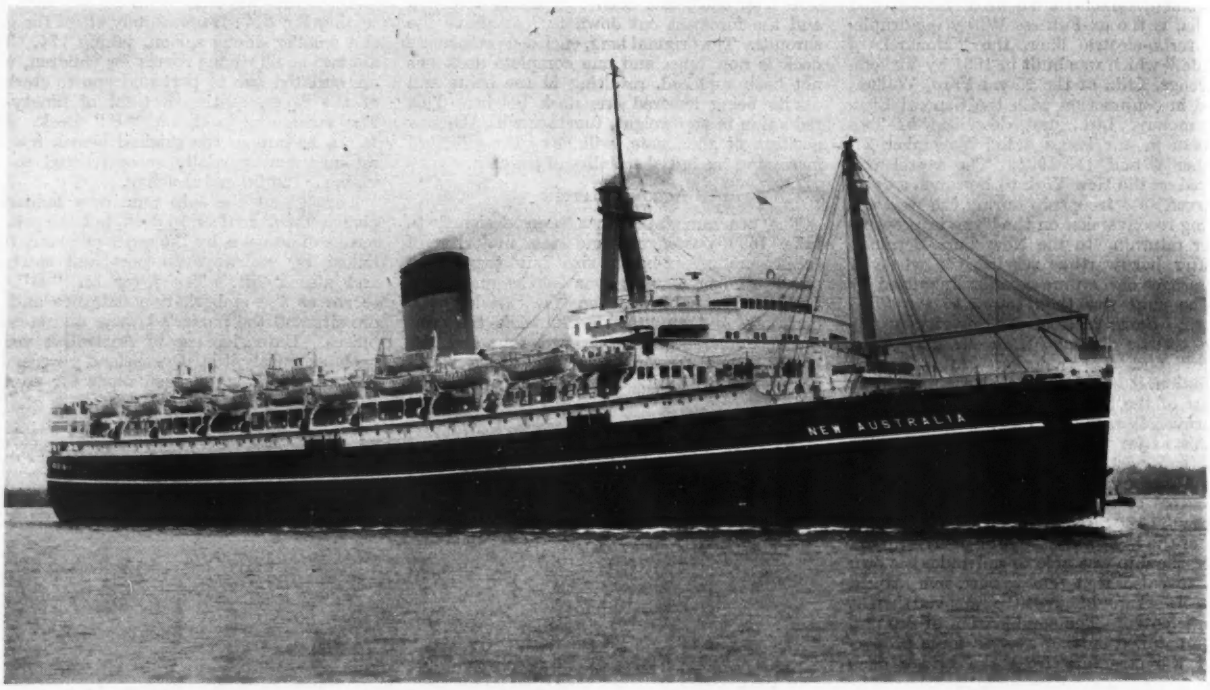
The accommodation provided for the officers and crew meets all the latest requirements of the Ministry of Transport. The engineers and officers have a separate dining saloon on the promenade deck aft, and the engineers have a general room and a duty mess on "A" deck aft, while there is a general room for the officers in the house on the boat deck forward. There are recreation rooms for the stewards on "B" and "C" decks forward and separate messes for seamen, firemen and greasers. A well-equipped hospital, complete with maternity ward and operating theatre, is placed right aft on "B" deck and there is a self-contained isolation hospital on the after end of the boat deck.

Ship Services

The galley, which is on "C" deck, between the two dining rooms, is all-electric and has been completely redesigned to cater for the increased number of passengers. Five lifts of varying capacities serve the cold chambers, 'tween deck stores and a three-hundredweight capacity lift serves the officers' and engineers' dining room pantry on the promenade deck and the engineers' duty mess pantry on "A" deck. All the storerooms and refrigerated chambers have been rebuilt and the refrigeration machinery reconditioned.

The ventilation system, which has been installed by Richard Crittall Marine, Ltd., meets the Ministry of Transport's requirements for emigrant vessels and provides a thermo-

statically-controlled supply of warm air to the passengers' cabins. Cold air is circulated to officers' and engineers' quarters and heating is effected by "Thermovent" radiators in each cabin and this form of heating has been adopted for all the public rooms. Fire protection for the ship is by the "Grinnell" sprinkler system, installed by Mather and Platt, Ltd., which also supplied the fireproof doors and the Kidde-Rich system of smoke detection. Extinguishing equipment has been fitted in the boiler-rooms, refrigerated chambers, baggage rooms and holds.



TURBO-ELECTRIC LINER "NEW AUSTRALIA"

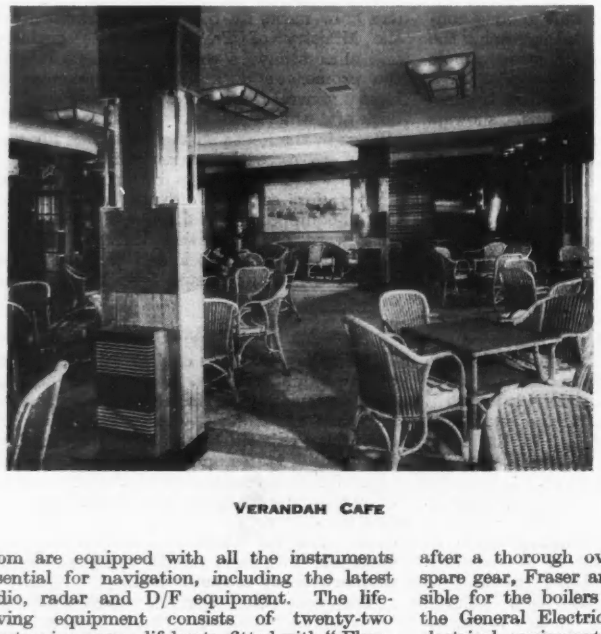
SHIP EQUIPMENT

The four 5-ton derricks mounted on tables at the foremast have been retained to serve the holds, which act as baggage spaces. The original deck machinery has been overhauled and retained. The wheelhouse and chart-room are equipped with all the instruments essential for navigation, including the latest radio, radar and D/F equipment. The life-saving equipment consists of twenty-two ninety-nine-person lifeboats, fitted with "Fleming" gear and built by the contractors, two motor lifeboats and two 26ft long emergency boats. The boats are carried in the original davits and the boat winches have been reconditioned by Welin-Maclachlan Davits, Ltd., which supplied the six sets of luffing winches, required to operate those boats that have been double-banked. In addition to repairing the water-tight doors, two new doors have been fitted to give access to store rooms on "E" and "F" decks. The total of power-operated doors in the ship is seventeen and two hand-pumps for the emergency system have been provided and installed on the boat deck.

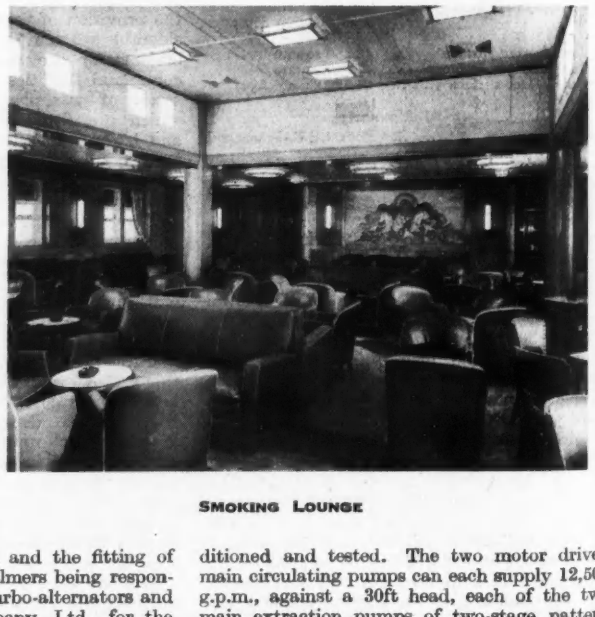
PROPELLING MACHINERY

The whole of the original propelling machinery, with the exception of certain minor additions and replacements, has been retained, after a thorough overhaul and the fitting of spare gear, Fraser and Chalmers being responsible for the boilers and turbo-alternators and the General Electric Company, Ltd., for the electrical equipment. The actual damage to the machinery by flooding was relatively slight and after a preliminary drying-out at Granton, the vessel was able to proceed, as we have already noted, under her own power to Southampton.

All eight Babcock and Wilcox water-tube boilers have been opened up and overhauled, including the boiler mountings. In each boiler the fire row tubes have been renewed and flexible oil fuel pipes to the burners fitted and the uptakes mainly rebuilt to suit the new design of funnels. The steam pipe-lines have been carefully examined and renewed as necessary and the main and auxiliary closed feed systems have been modernised, the temperature of the feed inlet to the boilers after three stages of heating being 300 deg. Fah. New parts have been fitted to the turbo-alternators, all four shafts have been realigned, new tail-shaft liners fitted and bushes renewed. All the auxiliary machinery has been reconditioned and tested. The two motor driven main circulating pumps can each supply 12,500 g.p.m., against a 30ft head, each of the two main extraction pumps of two-stage pattern can perform full duty and deliver 250,000 lb per hour and the two two-stage turbo-feed



VERANDAH CAFE



SMOKING LOUNGE

pumps have the same rating. A new steam and drain system has been fitted for the ships heating system, and the steam and exhaust drains in the machinery spaces modified. The drains have been led to a drain condenser in the forward engine-room and then through a filter to the feed water tanks in the double bottom. After thorough overhaul and testing, the original CO_2 refrigeration machinery, supplied by J. and E. Hall, Ltd., has been reinstalled and will continue to meet the requirements of the cold chambers.

The ship has been completely re-wired and new electrical fittings have been installed. In the machinery spaces all pump motors have been reconditioned, control panels and switchboards stripped and re-wired and working parts repaired, stators removed for balancing and propulsion motor rotor coils reconditioned.

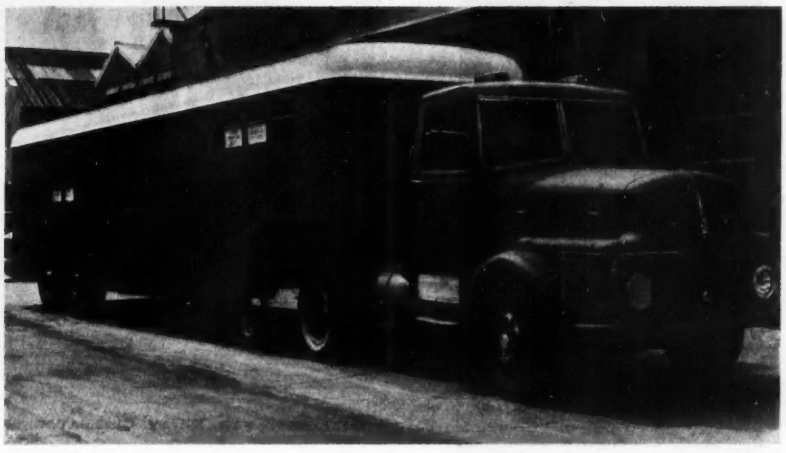
The Manganese Bronze Company, Ltd., supplied four new "Scimitar" propellers of modified design, because in the original vessel it was found that the inner shafts were absorbing more power than the outer. The inner propellers, which are outward turning, now have a mean pitch of 14·89ft and the outer propellers, which are inward turning, have a mean pitch of 15·31ft. All propellers are four-bladed and each has a diameter of 13ft 3in, an area of 73 square feet, and weighs 5·88 tons.

The trials of the "New Australia" have proved successful, a speed of nearly 20 knots being attained, with the propelling motors developing 19,390 s.h.p. Consumption trials at 18,000 s.h.p. indicated that the fuel required for all purposes was 0·83 lb per s.h.p. per hour.

The ship sailed on her first voyage in the colours of the Shaw Savill and Albion Company, Ltd., namely, black hull with white band, white superstructures and buff funnels, with black tops, on August 15th, carrying emigrants to Australia.

Large Semi-Trailer Passenger Coaches

WE recently took advantage of an opportunity to inspect some very large semi-trailer passenger coaches now being built in this country for an oil company in the East. These semi-trailer passenger coaches have for some time past been popular with oil companies as they provide an efficient and economical means of personnel transport in the field. With these vehicles it is not only possible to transport large numbers of passengers, but the tractor units, once they have hauled the semi-trailer coaches to their destinations, can be uncoupled and used with the other types of trailers for goods, &c., used on general transport work. Towards the end of last year the Kuwait Oil Company, Ltd., placed a contract for a number of the 100 and 80-seater semi-trailer coaches we inspected, with R. A. Dyson and Co., Ltd., of Liverpool, in order to augment and replace its existing fleet of passenger transport vehicles. R. A. Dyson and Co. sub-contracted the building of the bodies with the Express Motor and Body Works, Ltd., of Summerstown, London, S.W.17, and the vehicles were produced in consultation with the British Aluminium Company, Ltd.



SEMI-TRAILER COACH

The coaches are made in two models which are identical in respect to the chassis and body shell, the difference being in the seating arrangements. The vehicles with 100 seats are intended mainly for the transport of local labour and have slatted seats, whilst those having eighty seats will be used by clerical staff and have upholstered seating. Each of the coaches is 38ft 6in long, 8ft 6in wide, and weighs about 7 tons 7 cwt, and a photograph of a typical unit attached to a Thornycroft tractor is illustrated on this page.

The fabricated steel chassis frame shown in another of our illustrations is of double-cranked design, being upswept at the front and over the rear axles. The frame, although comparatively shallow, has the maximum possible ground clearance with the minimum loading level. It has a very small deflection under load, as any excessive flexing of this frame would set up strains in the body work which in time might have a harmful effect on the structure. To impart the necessary rigidity most of the main frame longitudinals are doubled, and instead of single members two heavy channels are welded back to back with a central reinforcing plate welded in between at the points of maximum stress.

The chassis frame is amply braced with cross members and a very heavy cruciform bracing is arranged amidships to prevent possible twisting. A number of outriggers are fitted to coincide with the body cross bearers.

The tandem axle rear bogie is of a type which R. A. Dyson and Co., Ltd., has specially produced for use on bad roads and has already been well tested out in service overseas. On each side there is a single centrally pivoted inverted semi-elliptic spring. The brackets which secure the axles to the springs are fitted with rubber block inserts designed to allow a limited amount of twist between the axle and the springs and relieve the axle of torsional stresses. As there are no shackle bolts or other wearing parts the axle design is particularly suitable for service under conditions where abrasive dust or sand might otherwise cause difficulty.

Girling brakes fitted to all four wheels are operated from the tractor by means of a two-line air pressure system and a separate hand-wheel and cable-operated mechanical control is fitted for parking. Single 14·00in by 20in Michelin shallow-tread pattern tyres are fitted to the wheels, and the king pin is of the S.A.E. pattern, so that the semi-trailer can be coupled up to existing tractors in use at the oilfields, all of which are fitted with American S.A.E. fifth wheels or the British equivalent. Vertical lift jockey wheels are raised and lowered by hand-crank-operated screw gear from the side of the vehicle.

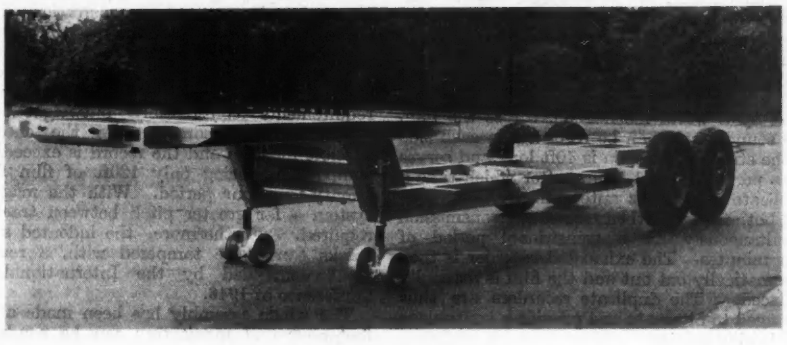
The coach body, which weighs only 2 tons 10 cwt 2 qr, is largely built of aluminium and aluminium alloy. The main body bearers are aluminium alloy channel sections to which standards of top hat section are attached by gusset plates secured by high-tensile bolts. The bearers are attached to the main chassis with high-tensile bolts and 'locking nuts, "Ferodo" packing being inserted between the bearers and chassis. The bearers are equally spaced and have T-section floor runners attached. Non-slip flooring is bolted to the bearers and runners.

The waist rails and light rails, equally spaced between the standards, are secured by angle brackets and the cant rails are also connected to standards by angle brackets. These cant rails are interesting in that each one is extruded in one length of 36ft 3in and specially drilled so that whilst being secure it permits interchangeability of the roof. All main window frames are also interchangeable and can be replaced very easily. The front of the body has been designed and built on lines similar to the body side.

The rear of body follows the design and construction of the side of body, allowance having been made for an emergency door, which is hinged from the outside and operated from both inside and outside the vehicle.

The roof has been built with top hat section extrusions contoured to special dimensions and forming roof ribs. The sections are contoured before full heat-treatment. Roof ribs are attached to the cant rails by angle brackets and are equally spaced by means of Z-section extrusions, and a number of plates are fixed to the ribs to carry interior light fittings and "Ashanco" ventilators. The whole of the framework of the roof is mounted in a specially built frame jig for the application of the outer skin. The inner skin is contoured before being fitted to the roof ribs.

Particular attention was necessary in design-



SEMI-TRAILER CHASSIS

ing the roof in view of the heat insulation problems imposed by operational service in the Middle East. The whole of the roof and the sides down to window top rail level have "Isoflex" pads 2in thick between a double skin of aluminium sheeting, the flexible pads being secured to the outer skin and roof ribs with "Durolac."

Twenty-five specially designed half-drop window frames in each coach have been fitted with toughened glass. These windows have rails on the outside of the framework to protect the glass, the rails themselves being attached by metal threads for easy replacement if necessary.

Double jack-knife entrance doors built centrally on the near side of the coaches can be operated from the inside or outside. They have two small fixed "pan" type windows and slide on a specially designed track.

Eight interior lights fixed to the roof at specified positions are operated from two switches near the main door just below the cant rail. On both near side and off side front and rear of the vehicles are fitted red and green clearance lights controlled from the tractor unit. At waist rail height on the front of the body is a red light which warns the driver when the passenger doors are open.

Seat frames for the eighty-passenger coaches are made from drawn steel tube and welded at the joints. They are upholstered in latex foam covered with leather cloth. Coaches providing seating capacity for 100 passengers have slightly longer seats which are fitted with teak slats in place of upholstery.

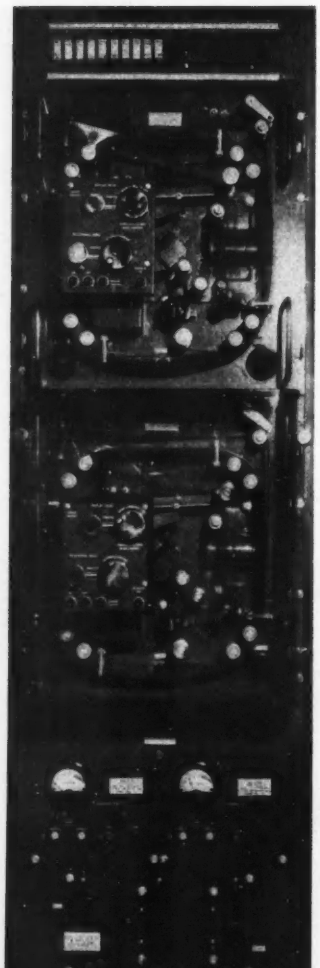
An Automatic Monitoring Recorder

THE Ministry of Civil Aviation demonstrated to Press representatives last week an apparatus for recording continuously and automatically very high-frequency radio communications between aircraft and ground control centres. It has long been realised that existing facilities for monitoring such work by long-hand have been inadequate and unreliable. Instances have occurred when vital messages have been insufficiently recorded or incorrectly timed, so that their value in establishing the cause or assessing the liability of accidents has been reduced.

Known as the Simon Monitoring Recorder, the apparatus was developed jointly by the Royal Aeronautical Establishment and the Ministry of Civil Aviation, with the firm of Simon Sound Service, Ltd., London. Reproduced on this page is an engraving of a complete assembly capable of responding to any one frequency in the range of 500/3000 c/s. On the initiation of a message the set is automatically triggered and commences to record with a delay of the order of milli-seconds. The signal is first amplified and then fed to a recording head which is similar in certain respects to a gramophone pick-up. The gain of the amplifiers is such that they are capable of satisfactorily recording signals down to input levels of −25db, with respect to 1mW through 600 ohms. By means of a sapphire needle in the recording head a lateral indent is impressed, without cutting, on a standard Kodak continuous film strip, the ends of which are fastened so as to include a 180 deg. twist. This strip is presented to the needle at a rate of 40ft per second. The lateral amplitude of the indent is about 0·29mm, and by advancing the recording head by a worm mechanism, across the film, 120 sound tracks can be recorded on each side of the strip. Each loop is 40ft long and serves for a period of eight hours, after which time a duplicate recorder is automatically tripped in and both machines then record the transmission simultaneously for a transitional period of four minutes. The exhausted recorder is then automatically cut out and the film is manually replaced. The duplicate recorders are thus arranged to alternate and provide a continuous monitoring service.

In later models the film will be synchronised with a master clock and time signals will be superposed on the track by a 300 c/s morse code.

The replaying head, recording head and reeling system are specially arranged to permit the replaying of any portion of the recorded signal, without disturbing the continuity of the recording. The replaying head can be traversed manually across the film, and in conjunction with a cyclometer calibrated to read time, the replaying head can be located



RACK FOR ONE R/T CHANNEL

on any sound track previously recorded, to within two minutes of the desired section from where the replay proceeds automatically. This arrangement obviously permits the recording and replaying of the same signal simultaneously. During the demonstration of this apparatus, the fidelity of the recording proved to be very high, but not up to the standard of the magnetic system of continuous recording. The advantages, however, in respect of other requirements considerably outweighed this aspect. The apparatus uses the cheapest possible medium and the record is exceedingly compact, requiring only 120ft of film for a twenty-four-hour period. With the magnetic system a far greater pitch between tracks is required. Furthermore, the indented sound tracks cannot be tampered with, a requirement demanded by the International Air Conference of 1946.

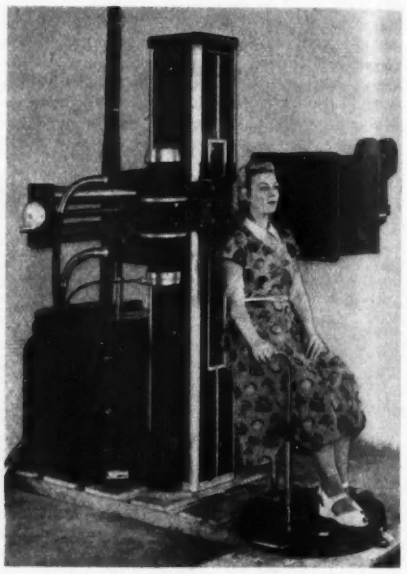
The whole assembly has been made almost foolproof, and monitoring can be conducted by a non-technical staff.

High Voltage Equipment for Cine-Radiography

A NEW high-voltage equipment for making cinematographic X-ray films has been introduced by Watson and Sons (Electro-Medical), Ltd., an associated company of the General Electric Company, Ltd., Magnet House, Kingsway, W.C.2.

The history of this development began in the years 1935–37, when Watson and Sons, in conjunction with Dr. Russell J. Reynolds, produced the first cine-radiography equipment. This equipment was arranged to take cine-radiographs by the indirect method (photography of a fluorescent screen), using 16mm film and a 10kW stationary-anode X-ray tube. To minimise the exposure of the patient to X-rays, the apparatus was fitted with a synchronous mechanical switching device, which reduced the voltage applied to the tube during the periods when the camera shutter was closed.

Although much useful work was done with this apparatus, it had some serious limitations. The patient could only be radiographed in an upright position, the equipment was cumbersome and had to be operated in complete



EQUIPMENT FOR X-RAY CINEMATOGRAPHY

darkness because of the long focal length of the lens used—a Zeiss Biotar, with an aperture of $F/0·85$, specially developed for the work. With the X-ray tubes then available this aperture was the minimum which could be used and because of its small acceptance angle, a long focal length (58mm to cover 16mm film) was unavoidable. Accordingly, the camera and fluorescent screen had to be mounted on separate stands to secure the correct reduction ratio and had to be operated in darkness. Other disadvantages were poor definition and "grainy" films, arising from the need to use a highly sensitive emulsion.

Compared with the early instrument, however, the new Watson equipment is a marked improvement. It uses a rotating anode X-ray tube energised at 120kV, 400mA, in conjunction with a specially designed 35mm cine-camera fitted with an $F/1·5$ Taylor-Hobson lens of 4cm focal length. The high-voltage generator has an electronic switching device, whereby the X-ray tube is only energised during the time that the camera shutter is open. The speed of the cine-camera can be adjusted from 3½–50 frames per second, in submultiples of the a.c. mains frequency, the driving motor being a synchronous machine.

Film loading and unloading is done in daylight. The unexposed film magazine holds 400ft of film and the exposed cassette up to 20ft. This length is ample for making endless

loops, in which form cine-radiographs are usually examined.

Our illustration shows the general arrangement of the equipment. The X-ray tube in the housing on the right of the patient, and the fluorescent screen and cine-camera on her left, are arranged on a balanced arm carried on a floor-mounted pedestal. The tube, screen and camera assembly can be rotated, allowing radiography to be carried out in any position from the horizontal to the vertical. The equipment is designed for use at focus-to-screen distances of 24in, 36in, 42in and 48in and the camera is arranged so that various sizes of fluorescent image can be photographed, which is analogous to using different sizes of cassettes in normal radiography. The camera, screen and tube assembly is adjustable to various heights from the floor by a simple handwheel adjustment and can be rotated about its axis by means of a motor drive controlled by press button.

A simple couch is provided for radiography with a prone patient, and a rotating platform is fitted for positioning the patient, or for rotating during radiography. To enable the radiologist to position the patient correctly, means are provided for visual inspection of the fluorescent screen through an aperture, which is self-closing, so that no light can enter during the time when the image is being photographed.

Operation of the equipment, once the patient has been placed in position, is from a separate control unit. The initial operation is to close a hand-switch, which brings in a preparatory circuit, energises the camera motor and the rotating anode of the X-ray tube. Then (after a three-second delay period, during which time the camera is synchronised, the X-ray tube anode runs up to speed and the tube and rectifier valve filaments are fully heated) an exposure button controls the exposure in conjunction with the synchronous timer, which is set for the total duration of the exposure required. The automatic contacts built into the camera then take charge during the exposure period and arrange for the X-ray tube to be energised only during those periods when the camera shutter is open. Besides reducing the X-ray dose to the patient, this limitation also reduces the power dissipated in the tube and enables higher loadings to be utilised without fear of tube failure.

For use at extremely slow film speeds, for example those used for viewing slow movements of the body, the X-ray exposure can be arranged to occupy any proportion of the shutter-open period. This timing is done by means of a subsidiary timing control in the electronic contactor circuits.

If desired the camera and timing and synchronising equipment can be switched out of use and radiographs made on large-size films by the usual still-radiography technique, the synchronous timer determining the length of exposure.

The complete apparatus is designed for use on 200/260V, 50 c/s, single-phase mains. Alternatively it can be operated in conjunction with an additional step-down transformer or static balancer from three-phase mains or single-phase supplies up to 500V. Power consumption is about 1kW when idling and 20kW (average) when exposures are being made.

High Tensile Bar Reeling and Shearing Machines

AMONGST the heavy equipment recently completed at the works of the Bronx Engineering Company, Ltd., Lye, Nr. Stourbridge, are the round bar reeling machine and the bar shears, which are illustrated in the engravings herewith. These two machines have been designed and built to deal with "Nimonic" and other high tensile steels at the works of Henry Wiggin and Co., Ltd.

The reeling machine is capable of handling mild steel bars from 1¼in up to 5in diameter and high tensile steel bars up to 4in diameter. It has two independent motor-driven gear drives, one for the convex and one for the concave rolls. The drives are transmitted through universal coupling spindles and are situated at opposite ends of the machine in positions well clear of bars entering and leaving the rolls.

The body of the machine is mounted on a heavy cast iron rolling mill type base and the main body units and top bridges are of cast steel. A long bottom bearer bar, on which rests the bar of steel being rolled, is adjustable vertically through a handwheel. A heavy cast iron support crown, mounted on the two cast steel bridges of the machine, carries the top bearer bar, which is also adjustable vertically through a handwheel operated gear. Each of the special alloy cast iron reeling rolls is mounted on nickel chrome spindles, running in phosphor bronze bearings set in cast steel window chocks.

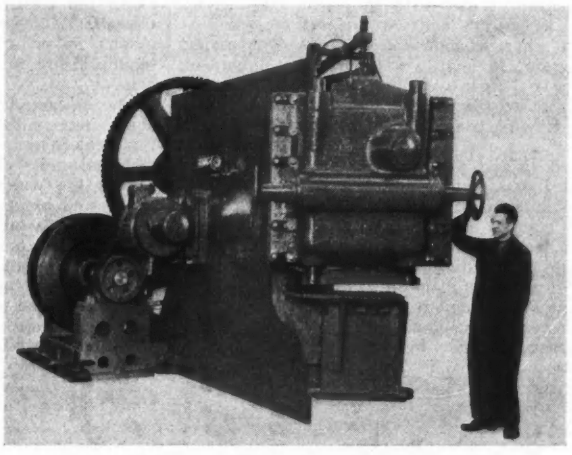
A 40 h.p. electric motor is fitted to each of the independent reduction gear drives for the rolls, and the universal spindles, through which power is transmitted to the rolls, are of the totally enclosed half-moon rolling-mill type. The weight of the heavy forged steel spindles is taken by spring-loaded centre support bearing blocks.

An air operated inlet trough of fabricated steel construction takes bars up to 17ft long and consists of two semi-circular halves. The bottom half is fixed and the top half is arranged to swing up to admit a bar for reeling and close when the bar is in position for the reeling operation. Rollers in the bottom half of the trough are positioned by means of pneumatic gear; they are raised to support bars during the loading operation and retracted below the level of the trough when the bars enter the rolls. An outlet trough on the opposite end of the machine consists of a large vee, which supports the bar after leaving the rolls. Bars are removed from this trough by pivoted lifting fingers on which they are swung over on to skids leading away from the machine. The troughs, which are not shown in the illustration, are adjustable both horizontally and vertically.

All of the controls for the machine are centralised to enable one operator, stationed behind the centre of the body, to control all operations.

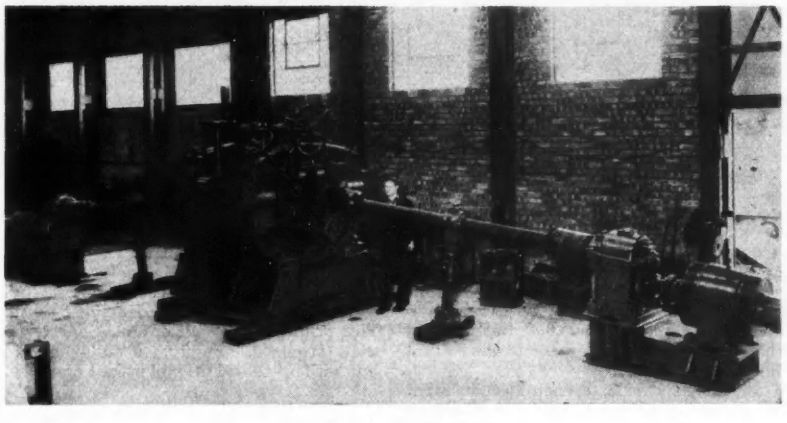
The bar shearing machine has been supplied to cut mild steel bars up to 4in square and 3in square high tensile steels of about 75 tons tensile at an angle of 30 degrees.

In this machine a steel casting forming the main slides and bottom cutter block is fitted into two rolled steel side plates 2in thick. The main slide is set at an angle of 30 degrees in respect to the centre-line of the machine. The main steel casting is bored and fitted with phosphor bronze bearings and the pitman, which works in a bronze seating in the bottom of the slide, has a bronze slipper at the head working in the slide. Adjustable bronze-lined slippers are fitted to take up any wear on the slides.



BAR SHEARING MACHINE

The machine is driven by a 30 h.p. motor through vee ropes and pulleys to a first motion shaft, on which is mounted a heavy flywheel. Drive is transmitted to the forged crankshaft through two pairs of machine-cut double-helical gears and all the shafts are mounted in heavy gun-metal lined pedestal bearings. The main slide is counterbalanced and an adjustable locking plate is mounted on the front slide. Lubricating oil under pressure is fed automatically to all the main moving parts of the machine.



BAR REELING MACHINE

PHOTOELASTICITY.—The University of London, University College, Faculty of Engineering, announces that courses in "Photoelasticity" will be held during the 1950–51 session. In Course "A," dealing with "The Principles and Methods of Photoelasticity," fifteen lectures and demonstrations will be given on the practical application of photoelastic methods to the investigation of two-dimensional stress distributions. Course "B" will deal with "Photoelastic Methods in Three-Dimensional Distributions," and in it will be given ten lectures and demonstrations on recent developments in the photoelastic investigation of three-dimensional stress problems.

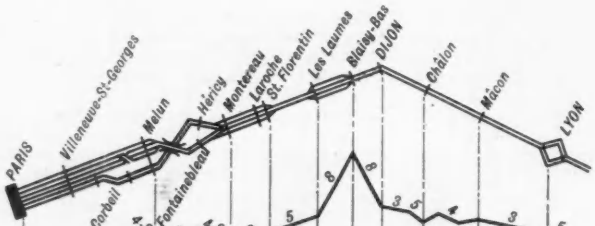
Power Supply for Paris-Lyons Electrification

IT is not surprising that the line from Paris to Lyons should be in the forefront of the post-war electrification programme, which is being carried out by the French National Railways (S.N.C.F.). Even before the recent war this important route, with its very dense traffic and severe gradients, was ripe for electrification. For, as indicated in the accompanying diagram, it links Paris with the important industrial centres of Dijon and Lyons; beyond, it leads to Blanzy and Creusot, the Alps, the St. Etienne basin, Marseilles, Switzerland and Italy.

Goods and passenger traffic between Paris and Lyons is probably heavier than on any line of similar length in France. The peak was reached before the war, when 155 express and fast passenger trains were carried in a single day and a daily average of more than 125 trains was maintained during the summer months. Although these figures have not been reached again since the war, normal daily passenger traffic in July, 1949, comprised sixty-four trains in both directions, between Paris and Dijon, and forty-two between Dijon and Lyons. Freight traffic is correspondingly heavy, totalling nearly 10,000 metric tons per kilometre per day. 10 per cent of the total traffic of the S.N.C.F. system is carried by the 512km section between Paris and Lyons.

Coal saving is perhaps the most important economic reason for French railway electrification. It is calculated that each kilometre of line already electrified means a saving of 370 tons of coal annually. With the heavier traffic envisaged on the lines now being electrified, a saving of the order of 700 tons of coal per year is anticipated. Ultimately a total annual saving of 2,600,000 tons of coal may be achieved and the benefits to the French economy are obvious.

On the technical side, French electrification follows the well-established 1500V direct current system. Nevertheless, it should be mentioned, in passing, that experiments are being made with a new system, based on single-phase, 20kV, but at a frequency of 50 c/s instead of the more orthodox 16⅔ c/s. For experimental purposes the new system is being applied to the single-track line from Aix-les-Bains to La Roche-sur-Foron in the Savoy.



THE PARIS-LYONS LINE AND ITS PROFILE

DIJON CENTRAL CONTROL ROOM FOR SUBSTATIONS

Power Supplies

Electrical energy for the electrified lines between Paris and Lyons is derived from large transformer substations on the extra high tension network of Electricité de France. Three such substations contribute towards the section from Laroche to Dijon. The first is Rousson, which is under construction, to the north of Laroche, and the second is Vielmoulin, in the region of Dijon; both of these substations are on the main 220kV transmission line, which links Genissiat with the Paris region. The third substation, Tonnerre, lies nearly midway between the other two and is fed from the 150kV line linking the Massif Centrale with the main distributing centre of Creney.

Between these three feed points the S.N.C.F. has built two 60kV lines to interconnect the traction substations, which are distributed along the electrified track. The two three-phase 60kV lines are carried independently on pylons, following the same general route, but separated by an average distance of about 30m.

The overhead lines consist of steel-cored aluminium conductors, made of seven steel and thirty aluminium strands, with a total cross-sectional area of 228 square millimetres. On the towers the conductors are spaced in the form of an equilateral triangle of 4·5m side, two lines being disposed on one side of the tower and one on the other. A steel-cored aluminium earth wire connects the top of the towers.

The towers themselves are 24·5m high and are of conventional lattice construction, designed to minimise the size of the foundations. A point of interest is the use of a deformable element between the tower and each of the arms carrying the conductors.*

In the event of a conductor breaking, the deformable element absorbs most of the eccentric loading without damaging the tower. This property gives an ordinary line tower the same strength, roughly, as an anchor tower, but without the additional weight and cost.

Spacing of Substations

Traffic over the Paris-Lyons line is characterised by a high proportion of night trains with a maximum density of eighteen trains per hour, or thirty trains in the two-hour peak period—the trains being of 750 tons and running at average speeds of 105km to 111km per hour. This traffic density demands a spacing of about 15km between substations, each of which houses two "traction groups" or rectifier units, with a nominal rating of 4000kW.

During slack periods one of the two units is sufficient to maintain the service, but during the busier periods both units are operated, the reserve capacity of the substation being fully absorbed. However, the three substations installed in the neighbourhood of Blaisy-Bas, feeding the most difficult section of the line (where the ruling gradient is 8mm per metre) are equipped with a third rectifier unit to act as standby. A similar provision is made at the Perrigny-Dijon substation.

In all, the Dijon-Laroche section, which is the first portion of the electrification to be completed, comprises thirteen substations.

* THE ENGINEER, June 10, 1949, page 649.

Substation Lay-out

Each traction substation consists essentially of three parts—an outdoor high tension station, arranged so that either of the two incoming three-phase lines can be connected to the busbars by sets of sectionalising switches; a 1500V busbar connected to the rectifier units through circuit breakers, and track circuit breakers between the d.c. side of the rectifier units and the contact lines.

At a typical substation the four high tension lines (two from the Paris direction and two from Lyons) terminate on the truss of a gantry structure, which runs parallel to the main axis of the station. On each side of this gantry are two sets of parallel busbars, one of the incoming lines being connected to each set of busbars through section switches.

At certain substations (every third or fourth one, depending on circumstances) the two lines are normally connected to the busbar on one side of the permanent way. These substations constitute automatic sectionalisation on the high tension side, the intervals between two such substations forming a high tension sector within which the other substations can be connected on either of the two lines.

To one of the two longitudinal sets of busbars there is connected, through isolators, a set of transverse busbars, which feed two 60,000/200V transformers for supplying the auxiliary plant and the rectifier units.

Rectifiers

The "traction groups" comprise transformers feeding mercury arc rectifiers similar to those used on earlier electrifications on the S.N.C.F. system, except that the nominal output capacity has been increased from 2000kW or 2750kW to 4000kW. Before ordering plant of this rating the S.N.C.F. had tried out prototypes, which were mounted on railway wagons to facilitate the preliminary trials and, ultimately, to act as mobile reserve equipment.

Briefly, the rectifiers are six-phase, eighteen-anode, continuously evacuated units, with water-cooled tanks. Each complete rectifier unit is installed in a separate compartment with the associated air-blast coolers for recooling the circulating water, and with the air-cored smoothing choke for reducing current ripple.

Facing the rectifier compartments and separated from them by a corridor is the switch

room for the d.c. output, which is controlled by a switchboard carrying a mimic diagram of the particular section of the system served by the substation.

The switchboard is built up of a number of panels arranged close to the controlled equipment, so as to reduce the cable runs. On one side of a central gangway the panels consist simply of the rear of the ironclad 1500V busbar chambers connected to the rectifiers and the outgoing feeders. On the other side a large panel controls the auxiliaries in the indoor and outdoor substations, and houses the relays, contactors, battery-charging controls and the "telecommand" system, which is being installed in a room behind the switchboard.

Behind the ironclad board is the line of d.c. switches. They are ironclad high speed circuit breakers; those connected between the rectifiers and the busbars are of 4000A capacity, those connecting the outgoing feeders are of 3000A capacity.

Central Control of Substations

Normally the switchboard described above is unattended, the substations being remotely controlled from a central operations room at Dijon. This arrangement not only helps to conserve manpower; it enables the operation of the substations to be co-ordinated to suit the changing traffic requirements.

Central control of traction substations has, of course, already been realised between Paris, Le Mans and Sète Nîmes, and the satisfactory experience gained therefrom has been applied to the Paris-Lyons electrification.

The fifty-two substations along the line are divided into three groups with the same geographical boundaries as three corresponding traffic divisions. Each group comes under the jurisdiction of a central control post (at Paris, Dijon and Lyons), installed in the same building as the corresponding traffic control post.

The Paris control centre is responsible for the operation of the sixteen substations on the Paris-Laroche section. The Dijon control centre, which came into service on March 15th, now controls the thirteen substations on the Dijon-Laroche section; ultimately it will also control another eight substations between Dijon and Lyons. Lastly, the Lyons control centre will serve the fifteen substations between Chalon-sur-Saône and La Guillotiere.

The three control centres are generally similar and the photograph reproduced herewith shows a view of the one at Dijon. Seated at a central desk, the operator is in telephonic communication with the railway stations, the substations, maintenance gangs, train despatchers, &c. The actual control operations are carried out on a switchboard, which is arranged in an arc of a circle and carries a mimic diagram upon which the state of all substation plant is automatically displayed. In addition, the switchboard panels embody ammeters to show the current contributed by each rectifier unit.

There is a panel for each of the substations in the system so that the controller has in front of him a diagram showing the essential connections of the whole network. By operating switches on the appropriate panel, the controller can, for example, open or close any isolators or circuit breakers in any of the outdoor substations; he can start up or shut down any of the rectifier units, and he can open or close any of the circuit breakers supplying the catenary wires. Warning of a fault involving substation plant is given by a klaxon, accompanied by the lighting-up of indicator lamps on the appropriate panel.

To obtain these results without requiring a large number of wires between each substation and the control centre, use is made of switching techniques similar to those of automatic telephony. Current impulses are used to translate any order given to a particular piece of substation plant and to carry the confirmatory signal back to the corresponding lamp on the switchboard.

In the Paris-Le Mans electrification in 1938, the desired result was brought about by using two pairs of conductors per substation. On the Paris-Lyons section the same result was effected by two telephone quads for the complete system. To obtain a separate transmission channel for each of the substations, signals of preset frequencies ranging from 420 c/s to 2460 c/s in steps of 120 c/s can be sent over the common wires, with filter circuits to provide discrimination. Each pair of wires can thus accommodate eighteen channels; each "quad" therefore carries eighteen channels from the control centre to the substations and eighteen channels in the opposite sense.

Motor Vehicle Alignment Testing Equipment

An interesting piece of dual purpose equipment has been developed by Newnhams, Ltd., 235, Hammersmith Road, London, W.6, for checking motor vehicle chassis and head lamp alignment. This equipment is light and portable and can be used by any intelligent mechanic to determine quickly and accurately the degree of the chassis misalignment under normal workshop or garage conditions. It consists essentially of four light alloy stands, on which are mounted sighting and viewing units, a gauging rod and a short plumb line. Two of the stands are used at the rear of the vehicle to be tested and the others at the front, in conjunction with the gauging rod and plumb line.

Testing Equipment in Use

Each of the stands used at the rear incorporates a horizontal telescope member, having a vertical periscope eyepiece at the rear. On each of the front stands is a substantial pillar, on which is adjustably mounted a sighting plate about 8in wide by 6in deep. Freely suspended from a horizontal bar at the top of the pillar is a sighting rod, which hangs down in front of the plate across the width of which it can be moved. The gauging rod used in conjunction with the front stands is longer than the width of the chassis and carries three sliding sleeves, one at each end and one in the centre. These sleeves have a line engraved round their circumference midway along their length and each can be locked in position along the rod by means of a thumbscrew.

The equipment is used as shown in the photograph we reproduce on this page. The vehicle to be inspected is first run on to a level floor area and its rear axle tested in the usual way to check that it is square in the chassis and that the axle shafts and wheels are true. A rear or viewing stand is then placed on each side at the rear of the vehicle, with machined pads on two upward inclined arms in contact with the wheel rim. With the unit in this position the telescope of the stand is parallel with the centre line of the chassis. A sighting stand is then set in front and a little to one side of each front wheel and its sighting bar moved across the front of its plate until it registers down the centre of the telescope lens of its respective rear, or viewing, stand.

With the stands in position, the gauging rod is set on vee-blocks below the sighting bars and its outermost sleeves moved along until their engraved centre lines register beneath the pointed ends of each bar. The plumb line is then suspended from the radiator of the vehicle and the vertical centre line taken through the centre of the starter dog at the end of the engine crankshaft. With its centre line in true register with the plumb bob, the centre sleeve of the gauging rod is then locked in position. At this stage the equipment is then fully set for determining the truth or degree of misalignment of the chassis. The gauging rod is turned end for end and its outermost sleeve lines registered beneath the pointed ends of the sighting bars. If the plumb bob is then over the line on the centre sleeve the chassis is in line; if it registers on one side or the other of the line the distance between the point and the line indicates the degree of misalignment.

The equipment can be used with equal facility for checking and adjusting motor vehicle headlights. In this case the viewing units are used to align a vehicle squarely with sighting bars suspended in front of a large, flat surface a predetermined distance in front of the car. The sighting bars are then slid horizontally along the front of the surface a sufficient distance, determined by simple computation, to bring them in line with the headlamps. A sphere on each bar is then moved up or down the bar to a predetermined position above the floor level, and on each headlight being focused on its corresponding sphere, the light beams are set to fall on the road surface at the required distance ahead of the vehicle.

The makers state that in a severely damaged vehicle multiple distortions can be pin-pointed within thirty minutes. Headlamp beams set in fifteen minutes.

Books of Reference

Handbook of the Fan Engineering Industry. London: Fan Manufacturers Association, Ltd., 23, Queen Square, W.C.1. Price 10s. 6d.—This, the second publication of the Association, is designed to make available to users at home and abroad, full information on the importance, wide variety and scope of the fan industry in this country. It deals in concise detail with the various types of fans and ancillary equipment such as air heaters, air cleaners, ducts and fittings, &c. The application of fans for ventilation in buildings, ships, mines, tunnels, &c., is covered, as well as their use for industrial dust and fume removal, drying, forced draught for kilns, boilers, furnaces, &c.

American Engineering News

(By our own Correspondent)

Pumped Storage Hydro-Electric Power

Although comparatively popular in other parts of the world, the pumped storage system of supplementing the output of hydro-electric power plants has been applied only once in the United States and is now operating, on a seasonal basis, at Rocky River, Connecticut. However, there was a certain revival of interest in this idea when the Allis-Chalmers Manufacturing Company, of Milwaukee, Wisconsin, demonstrated its new combination pump-turbine unit recently. The major advantage of the combination unit is the elimination of the need for additional pumping equipment; the same plant is employed both for off-peak pumping from a low-level to a high-level water reservoir and for peak-period power generation with reverse flow. The pump-turbine, which is shown in Fig. 1, is a single runner enclosed in a casing with a stay ring and movable wicket gates. Rotated in one direction it is a centrifugal pump; reversed, it functions as a hydraulic turbine. A section of the test loop, which was used to obtain performance curves of the unit, is illustrated in Fig. 2. It includes two identical pump-turbine models, one being tested as a pump and the other as a turbine in the same circuit. During the tests the gates of the pump and the turbine were set at the same opening, characteristics of each unit being determined from this gate setting. Capacity was measured with calibrated venturi meters, power input to the pump with a calibrated motor, power output of the turbine with a Froude hydraulic brake and the various heads with water manometers, mercury manometers or Bourdon gauges. Tests were conducted for different gate settings until enough data were obtained to draw a family of pump-turbine characteristics with gate settings as a parameter. Thus reliance was placed on the gates as well as on a compromise design of the runner in order to improve the "fit" between the pump-turbine characteristics and the characteristics of the external system. Tests which have been conducted to date on this equipment have yielded such satisfactory efficiencies (88 per cent when pumping, 87 per cent when generating) as to promise considerable savings over those obtained in pumped storage power plants where separate pumps and turbines are used. Economical operation of the combination unit is illustrated by the following hypothetical case: a unit is required to supply 5000kW at 163·6 r.p.m. for an eight-hour period, and there is a static head of 90ft between the full storage pond and the lower level suction pool drawn to its lowest level. With an average of 9700 b.h.p. being required, 8·53 hours of pumping would consume 82,700 horsepower-hours or 63,600kWh at 1·0 power factor. At 0·4 cents per kilowatt-hour the total cost of pumping would be 254·40 dollars. Power generated would amount to 40,800kWh, which could be sold for 1½ cents per kilowatt-hour in peak load periods and thus have a total value of 510 dollars—a ratio of return of about 200 per cent.

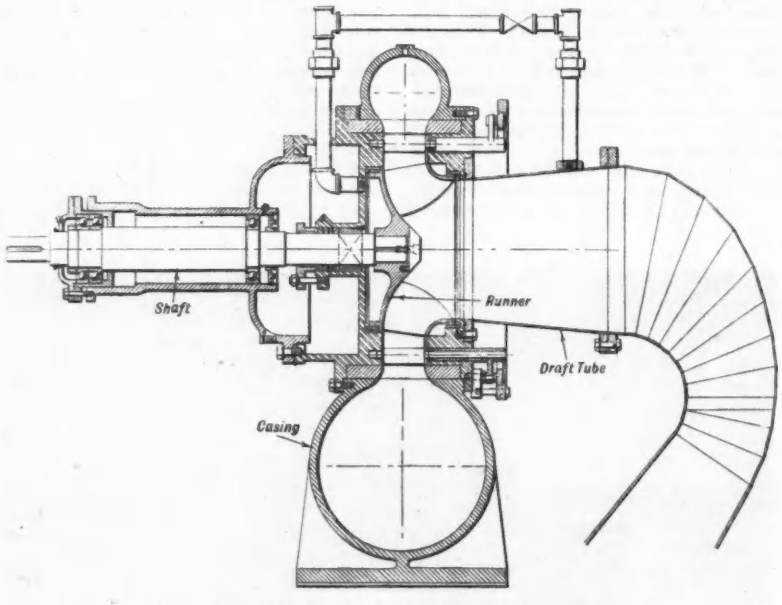


FIG. 1—COMBINATION PUMP-TURBINE UNIT

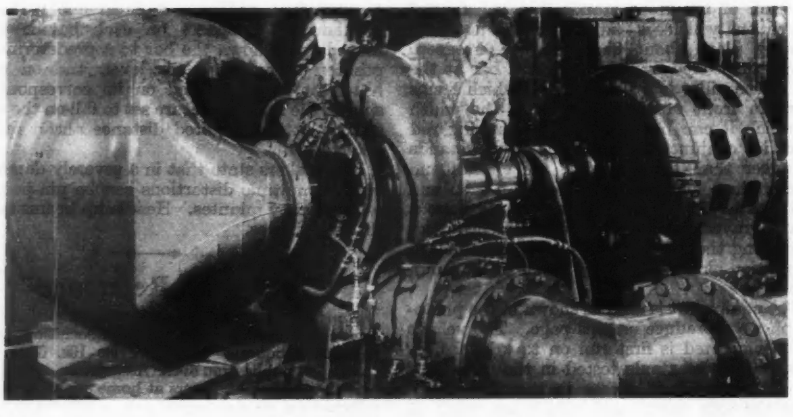


FIG. 2—PUMP-TURBINE TEST LOOP

Development of the Cumberland Basin

Sixteen dam projects are now under construction or being designed by the U.S. Army Corps of Engineers in the Cumberland Valley. The River Cumberland rises in South-Eastern Kentucky, forms a bend across Northern Tennessee and comes back to Kentucky, emptying into the Ohio River. The ultimate capacity of all the power installations planned will be in the region of 900,000kW. The major individual project of the scheme is Wolf Creek dam, which, when completed, will have the third largest hydro-electric plant in the Eastern United States, with a capacity of 270,000kW. Its reservoir will have a storage capacity of 6,089,000 acre-feet. The first of its six 45,000kW generators is scheduled to be in operation by the end of next year. Center Hill dam on the Caney Fork River, a Cumberland tributary, was completed for flood control purposes in 1948. It is 240ft high and has a storage reservoir capacity of 2,092,000 acre-feet. The first of its three 45,000kW generating units will commence operation in December. One of the smaller projects, Dale Hollow dam, on the Obey River, has had two 18,000kW units in operation since December, 1948.

New Wharves at Port of Houston

An unconventional design was adopted in the construction of two large wharves situated in the turning basin of the Port of Houston, Texas. The wharves are the first of several similar structures being planned by the Houston Port Commission as part of its post-war programme of dock rebuilding and water-front rehabilitation. The principal innovation in the design involved is the use of a series of interlocked cells, fabricated of steel sheet piling, to serve as a bulkhead behind the fender system of the wharf and extending to more than 70ft below the apron. The upper part of the cells is filled with compacted sand and other materials to provide rigidity. A concrete wall supported on steel bearing piles extends from the top of the cells at the waterline up to the apron and provides the harbour face of the wharf. Compacted earth fill above and behind the cells forms the foundation for the apron, and the wharf sheds and superstructure. The use of concrete piling was avoided without reducing the strength of the structure. The fronts of the cells extend well below the mud line of the harbour and serve as an effective cut-off against subsoil seepage or wash. The aprons of the new wharves are 500ft long and 50ft wide and have three railway tracks. The wharf sheds are 150ft in width and 500ft long.

Industrial Production and Productivity

President Truman's Mid-Year Economic Report to the Congress of the United States contains some interesting statistics relating to industrial production, employment and productivity. The index of industrial production in the United States, which had been 110 both in 1929 and in 1939, was 170 in 1946, the first full year after the war. At the present turn of the half-year it had risen to 199, higher than ever before in peacetime and 23 points higher than the average for 1949. Civilian employment averaged 47½ million in 1929 and 45½ million in 1939. It averaged 59½ million in 1948, declined to 58½ million in 1949, and mounted to almost 61½ million in June, 1950. Using 1929 as the base year, it is estimated that the index of total output per man-hour for the American economy as a whole was about 125 in 1939. During and since the war there have been considerable gains in productivity, and for the first half of 1950 preliminary estimates indicate that the index has risen above 165. Even without an unusual increase in the labour force or the hours of work, the present material and human resources of the American economy are considered sufficient to raise total production by the end of this year to an annual rate about 8 to 10 billion dollars above the current rate. Measured in current prices this would result in an annual output rate of well over 275 billion dollars.

Industrial and Labour Notes

A European Coal and Steel Plan

Seven British Conservatives taking part in the meeting of the Council of Europe at Strasbourg have outlined proposals for the regulation and development in common of the coal and steel industries of Europe. A resolution recommending that the Committee of Ministers should forward the proposals to the Governments taking part in the Paris discussions on the Schuman plan was tabled with the necessary number of signatures. The chief objectives of the Schuman plan—amongst which are the economic desirability of developing the coal and steel industries in common and of the progressive establishment of a single market in these products—were accepted in the proposals. The main difference in the Conservative and the French plans is in that the Conservatives suggest that the authority set up to direct the single market for coal and steel should be appointed by, and responsible to, an economic sub-committee of those members of the Committee of Ministers of the Council of Europe who decided to sign a treaty linking their coal and steel industries. Under the proposed scheme a country could appeal to the ministerial committee against decisions of the authority on the ground that they adversely affected the basic economic, social or strategic policy of a member. Any member of the authority or of the ministerial committee would be able to make the appeal and the committee would need to confirm the decision by a two-thirds vote, a proviso being that if the question under review affected more than one country only the member representing that country could veto the suggestion. Members of the authority would be drawn from employers, trade unions and consumers, and, unlike the Schuman plan, the scheme envisages two executive boards, one for coal and one for steel. Voting power on the authority and on the two executive boards would be proportional to production and consumption of coal or steel. The responsibility for mitigating the social effects of establishing a single market and other forms of rationalisation would be undertaken jointly. Under one provision the authority would be empowered to raise a levy on units of production which benefit from rationalisation to be used for such purposes as guaranteeing the service of loans which might be required. Other features of the plan included the development and supervision of a common policy for coal, steel and steel-making materials, an immediate aim being to charge the same price at the pithead or the works to all buyers whose demands were similar. Such a price policy should, however, lead to a levelling up rather than levelling down of wages and living conditions. The authority would not interfere with systems of ownership. In an annual report to the ministerial committee the authority would be able to suggest modifications to the treaty binding the member countries. This report would ultimately be laid before the Consultative Assembly. Since the scheme was put forward reports suggest that, from the French reaction, it is not likely to be generally acceptable on the Continent.

Overseas Trade in July

According to the provisional trade figures for July just issued by the Board of Trade, the United Kingdom exported goods to the value of £182 million as compared with £175·8 million in June. There were twenty-six working days in July and when the export figure for June was adjusted on a twenty-six-day basis the export figure for that month was £182·9 million—the highest on record. This country's exports in the second quarter of the year averaged £169·4 million a month. The value of imports in July, provisionally £225·3 million, was about the same as the high level reached in the second quarter of the year, £225·2 million, and was £38·4 million more than in July last year. With re-exports at £6·2 million the excess of imports, valued c.i.f., over exports and re-exports, valued f.o.b., was £37·2 million. These figures show an adverse balance of trade for this year of £256·9 million up to date, compared with £239 million for the corresponding period of last year.

Coal Production

During the week ended on August 5th, the coal output in this country was the lowest since the Christmas and New Year holidays. Deep-mined production at 2,715,800 tons, was down by 917,000 tons and open-cast production, at 246,200 tons, was down by 36,600 tons, compared with the previous week. This drop in production was expected owing to the large number of miners taking their holidays in the week before August Bank Holiday. The total manpower engaged in the mines remained unchanged at 696,800 during the week ended July 29th, but the number of coalface workers fell by 300 to 288,000 during the week. The total percentage absenteeism increased from 11·26 to 13·13 during the week under review and this increase is stated to be largely due to the increase in voluntary absenteeism from 4·77 to 6·18 per cent amongst the miners. In a letter sent to the Divisional Chairmen of the Coal Board Lord Hyndley stated that the need for coal is even more urgent now than last year, and he asked that the autumn production drive should start a month earlier. The weekly demand for coal now is nearly equal to what is being produced, he pointed out, and little is left over to meet overseas demands and stock up for the winter.

Factory Building Relaxations in Development Areas

In the course of an address when opening a new factory for the manufacture of carbon black at Ellesmere Port, the President of the Board of Trade gave some particulars of new arrangements for building projects in the Development Areas for industrial concerns willing to give employment to male labour. As reported in the Board of Trade Journal, the President said that the problem on Merseyside and in certain other parts of the country was one primarily of providing employment for men. It was a problem particularly severe in those areas where redundancies might be expected to occur through a decline in activity in ship-building and ship-repairing, through the closing of pits in areas where the coal was nearly worked out, or parts of the country affected by reorganisation of the steel and tinplate industries. The new Distribution of Industry Act was designed to supplement the Government's power under the 1945 Act, to induce industrialists to move to the Development Areas. But, as Parliament recognised when the Bill was going through earlier this summer, more inducement would clearly be needed. The Government had therefore decided that, within the total amount of investment resources available to the community, certain building projects could be allowed to go forward if they were to give permanent employment to predominantly male labour in these areas, even though they did not qualify for building facilities under the existing capital investment tests; that is even though they did not satisfy the strict dollar-earning or dollar-saving criterion.

The areas which would benefit from this special relaxation were certain localities in the Development Areas and certain places outside the Development Areas—Portsmouth, Hull, Barrow, West Cornwall, and parts of North Wales, though clearly from time to time the list of areas might need to be altered. He hoped that, as a result of this announcement, industrialists who were prepared to go ahead with building factories designed to employ predominantly male labour in these areas, but who had been held back by the capital investment restriction, would now come forward again. He would like it to be known to industrialists, in all parts of the country, that the Board of Trade would be prepared to receive applications from them for projects of this kind provided they were prepared to set up manufacture in the areas mentioned.

Economic State of Western European Countries

A report recently issued by the Organisation for European Economic Co-operation stated that most countries of Western Europe had achieved a reasonable balance between inflation and deflation, and added a warning that increased defence expenditure might compromise the progress achieved if care was not taken to combine economic policy as a whole with the normal implications of such expenditure. These conclusions were made by a working party which examined the internal financial situations and policies of sixteen member countries. Much of the report, which covered the whole of 1949 and the first months of this year, dealt with the effects of devaluation. These effects, it was concluded, had been moderate since a major part of the trade of O.E.E.C. members was with countries which devalued at the same time. For this reason the rise in import prices had been reduced and internal repercussions had been minimised. In most cases, however, some rise in prices had been general throughout the sixteen nations and in several countries this had created problems arising out of pressure for higher wages and other personal incomes. In the field of private consumption the report considered that much of the deferred demand from the period of wartime scarcity had been made up.

Gas Supply in Scotland

Speaking at a Press conference in Edinburgh last week, Mr. A. T. Morrison, chairman of the Scottish Gas Consultative Council, said that although Scotland was using 50 per cent more gas than in 1939, little or no money had been spent on plant renewal during the war years. The expenditure of very large sums of money had already been authorised by the Gas Board for extension and renovation of gas-producing plant in Scotland. On reconstruction and extension works at the Dawsholm works in Glasgow, some £450,000 was to be spent and other projects in the West of Scotland included an underground concrete tank for the storage of liquid residuals in Lanarkshire at a cost of £40,000. In Edinburgh the vertical retorts at Granton were to be extended at a cost of £220,600, to provide the estimated increase of output, and replacement of other equipment would cost some £22,460. Mr. Morrison gave particulars of a number of other approved schemes and announced that the consultative council had approved the setting-up of five district committees for the existing gas divisions in Scotland.

The Employment Situation

Figures issued by the Ministry of Labour show that there was a decline, 10,000, in the number of unemployed in this country during the month ended July 10th, there being at that date 272,000 unemployed persons registered for employment. Estimates showed that the total working population of the country increased by 4000 women to 23,328,000. The number of people in civil employment increased by 12,000 men and 11,000 women to 22,354,000. In the basic industries of coalmining, gas, electricity, water, transport, agriculture, fishing, &c., 4000 more people were employed, although there was a decrease of 1500 in the number of wage-earners on colliery books. The figures show that in the metals, engineering and vehicles group the manpower employed decreased by 8000 persons.

French Engineering News

(From our French Correspondent)

THE annual report of the Renault Regie for 1949 showed a total turnover of nearly 60 milliard francs. The report noted a relative stability in the price of raw materials, appreciable increase in salaries, and a marked drop in sale prices during the year. There was still difficulty in obtaining supplies of plating for bodywork. This deficit in French production persisted, and stocks for certain types consisted only of a few days' needs. It was hoped, however, that the completion of the continuous rolling mills now being built will soon solve this problem. In 1949 the Renault Regie exported 33 per cent of its production, of which 12 per cent went to the French Union and 21 per cent abroad.

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Efforts by French industry to obtain markets in India have recently included the establishment of United French Industry at Bombay. Negotiations are at present taking place, and it is hoped to obtain work for the benefit of the electrical and mechanical industries, suppliers of steel and concrete, and public works contractors.

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A programme of public works involving expenditure of some 350 million francs was approved at the last meeting of the Touquet Municipal Council. The programme includes 150 million francs to be spent on harbour facilities and 120 million francs on sea defence works.

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A report on the five-year plan for French aviation has just been presented to the National Assembly by the National Defence Commission. The plan covers the period 1951–55, and the first part will involve an expenditure of 189,500 million francs and the second 83,500 million. The number of types of aircraft to be constructed has been limited to eight for the Air Force and five for the Navy ; 13,400 million francs will be used by civil aviation for the study of turbo-propeller aircraft. The plan does not include the construction of heavy bomber aircraft, which could not be produced at the moment without inconvenience to work in other directions.

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Considerable unemployment is expected at the Chantiers de Penhoet, following the entry into service of the "Liberté," particularly among specialists, who will not find suitable work on smaller vessels. The number to be dismissed is estimated at over 500.

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Production of automobiles reached record figures for June, 1950. The total was 34,401 vehicles ; 32,137 were produced in May, 1950, and 25,459 in June, 1949. The June total was made up of 25,183 private cars, 5943 light lorries, 3038 lorries, 187 vans, 35 tractors and 15 special vehicles.

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The construction of a power station has now been started at Dechy. Orders have been placed in the United States for two 50/60MW turbo-alternators, which will be installed with one boiler per group. The first deliveries of material are expected next winter and the plant is expected to come into service in about two years time.

* * *

French steel production was maintained in June, 725,000 tons of steel and 650,000 tons of cast iron being produced, against 724,000 tons and 653,000 tons respectively in May. Finished products for June amounted to 505,000 tons, against 490,000 tons in May. Saar steel production was 127,000 tons in June (136,000 tons in May), cast iron production was 114,000 tons (against 126,000 tons), and finished products 98,000 tons (against 97,000 tons).

Reconstruction of the works of the Société Metallurgique de Normandie is at present nearing completion and the first Martin steel oven started working in July at Caen-Mondeville. The blast-furnaces are expected to be lit within the next few weeks.

Notes and Memoranda

Rail and Road

NATIONAL TRAFFIC CENSUS.—The first national traffic census arranged by the Ministry of Transport since 1938 is now taking place. It is being made during the seven days from Monday, August 14th, to Sunday, August 20th, inclusive, to determine the growth and trend of modern traffic, and particularly the changes which may have occurred in the general traffic pattern since the war. Because of the need for economy and also the shortage of labour, the census is being made on a smaller scale than those conducted before the war when traffic counts were taken periodically at three-year intervals at some 5000 points on Class I and about 4000 points on Class II roads alternately. It is being taken at 270 points as widely distributed as possible on Trunk, Class I, and Class II roads throughout England, Scotland and Wales so as to cover all classes of traffic in town, industrial, and country areas.

RADIO CONTROL OF COUNTRY BUSES.—A problem to which London Transport's country bus and coach department has been giving special attention is the economic provision of duplicate vehicles for special events and to cater for day-trippers to well-known spots at week-ends. With a view to solving the latter part of this problem, experiments have been carried out on recent Sundays with a radio van in direct radio-telephonic contact with a control post at the Dorking bus station from which many of the relief vehicles normally run. A system of radio control for buses was first tried at Epsom Races in 1948, and the success with which it then met led to a proposal to try a similar system for queue reduction in the Dorking area. One radio van has been put into service and, at the moment, has been found adequate for the purpose. The equipment used consists of a Pye 10-watt radio-telephone, employing a 5-valve transmitter and an 11-valve receiver, the frequency range being 27 to 132 Mc/s.

Air and Water

"ARUNDEL CASTLE."—September 21, 1950, marks the return of the "Arundel Castle" to the mail service of the Union Castle Line after an absence of ten years. During the war years she had been engaged in trooping, repatriation work and on the immigrant service to South Africa. The vessel has been reconditioned by Harland and Wolff, Ltd., at Belfast, and the opportunity has been taken to effect certain improvements to bring her up to the standard of the company's latest mail vessels. Originally accommodation was provided for 594 passengers in three classes, and in the new arrangement only two classes are catered for, the vessel now carrying 169 first-class and 371 tourist class passengers.

SHIP-TO-SHORE RADIO BROADCASTING.—Marconi marine radio equipment installed on board the Argentine liner "Eva Peron," was used as a broadcasting studio recently, during her maiden voyage from London. The equipment used for the broadcast was a Marconi "TGS 571 E" high-frequency, 500W radio-telephony transmitter. Tests made with this equipment radiating to Buenos Aires from the "Eva Peron," soon after her departure from London, were so satisfactory that it was decided to arrange for public broadcasts from the ship, for retransmission over the Argentine broadcasting network. At one point in the transmission it became necessary to alter the frequency to avoid interference experienced from a strong morse signal. Using the automatic frequency-changing facilities embodied in the transmitter the programme break during the change-over was limited to ten seconds. We learn that regular broadcasts from the "Eva Peron" are proposed in the near future.

Miscellanea

EUROPEAN COAL PRODUCTION IN JUNE.—According to the figures published by the United Nations' Economic Commission for Europe, the production of coal in Europe in June was about 2 million tons greater than in the June of 1949. This increase was mainly due to the increased output of more than a million tons in the United Kingdom and nearly 900,000 tons in Western Germany.

"COMPTEURS ET INSTRUMENTS DE MESURE."—A well-illustrated descriptive catalogue printed in French has been published by George Kent, Ltd., Luton, Beds. This catalogue (Ref. No. 1002) is entitled "Compteurs et Instruments de Mesure," and describes in detail the Kent range of industrial instruments and controllers. We learn that a similar edition is available in Italian and that the corresponding versions in Danish, Swedish and German are now being printed.

ZINC ALLOY DIE CASTINGS AND PRODUCTIVITY.—An interesting booklet, "Zinc Alloy Die Castings and Productivity," has been issued by the Zinc Alloy Die Casters Association. This publication, which is founded on a technical address given by Professor T. U. Matthew, of Birmingham University, draws attention to the possibilities offered by the zinc alloy die casting process towards meeting the demand for increased productivity. Copies can be had on request to the Association at Lincoln House, Turl Street, Oxford.

IRON AND STEEL PRODUCTION.—The monthly figures issued by the British Iron and Steel Federation show that despite the fact that steel production in July was affected by holidays, it was at an annual rate of 14,366,000 tons as compared with 12,697,000 tons in July, 1949. Pig iron output was at an annual rate of 9,099,000 tons, compared with 9,224,000 tons last year. During July steel output was at a weekly average of 175,000 tons and pig iron 276,300 tons. The previous best July steel output was in 1940, when the annual rate attained was 13,145,000 tons.

STANDARDISED SWITCHGEAR.—A new publication from the Brush Electrical Company, Ltd., Loughborough, entitled "Standardised Switchgear" shows how, although standardisation of complete switchboards is difficult, the requirements of heavy industries can be met in a few basic designs with optional extra fitments. The booklet refers to thirteen basic units of Brush metalclad vertical draw-out switchgear, and gives examples of the way in which these basic designs can be employed to save time and money in ordering equipment for specific technical requirements.

THE INSTITUTE OF PHYSICS.—The board of the Institute of Physics announces that the Institute's Certificate in Laboratory Arts will not be awarded after 1951, owing to the establishment of the Intermediate Certificate for Laboratory Technicians by the City and Guilds of London Institute. For some time it has been felt desirable that there should be established a Certificate which would be of value to technicians in a wider range of laboratories. Following conferences, the City and Guilds of London Institute agreed, in 1949, to set up an Exploratory Committee to suggest suitable conditions and syllabuses for such an award. The Institute of Physics was represented on this committee, the work of which has resulted in the publication of regulations and syllabuses which are coming into operation in the session 1950–51.

SYMPOSIUM ON HIGH-TEMPERATURE STEELS.—The Iron and Steel Institute is organising a symposium on "High-Temperature Steels and Alloys for Gas Turbines," to be held in London on Wednesday and Thursday, October 18th and 19th. There will be two sessions each day, beginning at 10.30 a.m. and 2.30 p.m., in the lecture theatre of the Institution of Civil Engineers, Great George Street, Westminster, S.W.1. A dinner for those attending will be held at the Hyde Park Hotel, Knightsbridge, S.W.1, on Wednesday, October 18th, at 7 p.m. for 7.30 p.m. On the evening prior to the symposium, Tuesday, October 17th, the Institute's fifth Hatfield Memorial Lecture will be delivered at 8.30 p.m. by Air Commodore Sir Frank Whittle, F.R.S., in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. Those interested in the symposium are invited to apply for full details of the arrangements to the Iron and Steel Institute, 4, Grosvenor Gardens, London, S.W.1.

COURSE FOR WORKS AND PLANT ENGINEERS.—A refresher course for works and plant engineers is to be held in the Great Hall of the University of Nottingham. Papers, by specialists drawn from industry, will be presented weekly on Monday evenings for a period of twenty-three weeks, commencing in October, 1950. Each paper will be followed by discussions. The course has been organised by a committee, which includes the Regional Chairman of the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Institute of Fuel, the Institution of Heating and Ventilating Engineers, and the Institution of Plant Engineers, in collaboration with the Regional Advisory Council for Further Education, the Ministry of Fuel and Power, the University of Nottingham, the Nottingham and District Technical College and the East Midlands Kindred Engineering Societies. The syllabus is designed not only to increase knowledge but to make more effective use of existing knowledge ; to promote the application of advanced techniques in works engineering practice over an extremely wide field. The Secretary to the course, from whom all information can be obtained, is Mr. P. Bailey, Ministry of Fuel and Power, Chalfont Drive, Nottingham.

British Patent Specifications

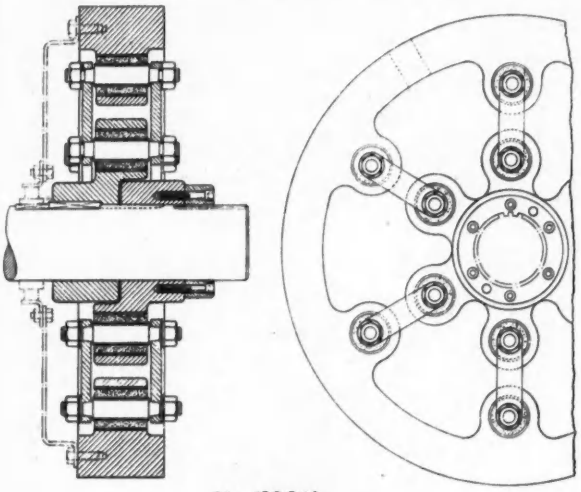
When an invention is communicated from abroad the name and address of the communicator are printed in italics. When an abridgment is not illustrated the specification is without drawings. The date first given is the date of application; the second date, at the end of the abridgment, is the date of publication of the complete specification.

Copies of specifications may be obtained at the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, W.C.2, 2s. each.

MISCELLANEOUS

638,246. February 17, 1948.—A New or Improved Torsional Vibration Absorber or Damper, Metalastik, Ltd., of Evington Valley Road, Leicester, and Archie John Hirst, of the company's address.

According to this invention a torsional vibration absorber or damper for a rotating shaft comprises an annular rim or inertia member carrying a number of angularly spaced pins or pegs having their axes parallel to that of the shaft and connected by substantially radial links parallel to pins or pegs on a hub member or hub members mounted on the shaft, bonded rubber or like bushes being provided at each end of the links between the links and the pins or pegs. The stiffness of the damper is dependent on the initial angle of inclination of the links to the radial position so that the stiffness can be easily adjusted to suit different applications of the damper. In a modified construction the inner ends of all the links are connected to pins or pegs on a common hub member on the shaft while the outer ends of alternate links are connected to separate annular inertia members which are angularly movable relative to each other and are provided with means for securing them together in the adjusted position. The accompanying drawings show a vertical section of the damper in a plane containing the rotational axis of the damper and an end elevation of the damper partly broken away, and indicate the general construction of the damper.—*June* 7, 1950.



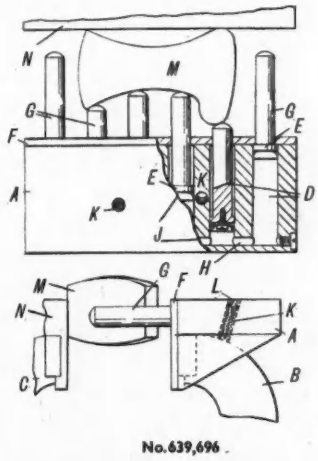
No. 638,246

639,676. August 29, 1947.—Improvements in the Protection of Ferrous Metal Surfaces Subject to Contact with Hot Furnace Gases, William Edward Ballard, of 20, Croftdown Road, Harborne, Birmingham, 17, and Walter Fred Harlow, of "Lamorna," Burley Road, Quarndon, near Derby.

This invention relates to the protection of ferrous metal surfaces used in high-temperature boiler installations, subject to contact with hot furnace gases, particularly superheater tubes for the reduction or prevention of corrosion. It provides a process which includes the steps of spraying the tubes with aluminium to a suitable thickness, and subsequently treating the aluminium surface with a partly hydrolysed organic silicate. The thickness of the aluminium coating may be between 0·002in and 0·010in, and the solution is allowed to dry on the aluminium coating, and several applications of the solution may be made if desired. One method of protection which has been found to give good results is to apply a coating of aluminium by spraying with the wire process to a thickness of approximately 0·006in, and afterwards coating the aluminium with a solution of ethyl silicate. The solution used may be as follows: 81 parts by volume industrial methylated spirits, 30 parts 0·06 per cent hydrochloric acid, and 190 parts ethyl silicate. These materials are shaken together for a period of approximately twenty minutes, and then a further 160 parts of ethyl silicate are added, and the solution is used after standing for not less than one hour, or more than six hours. The solution may be applied to the aluminium surface by spraying or brushing, and one or more coatings may be applied. It has been found that the aluminium deposit takes up a film of silicon which reduces or eliminates corrosion and the catalytic effect.—*July* 5, 1950.

639,696. February 11, 1948.—Improvements in and Relating to Clamping and Like Devices, Herbert John Caudle, of 62, Stanhope Grove, Eden Park, Beckenham, Kent.

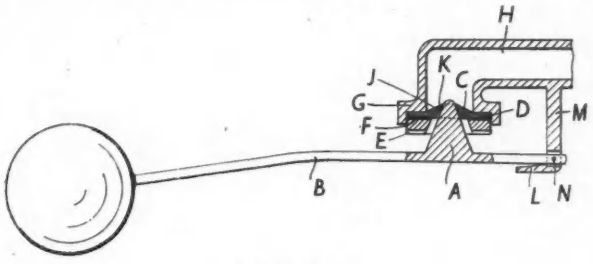
This invention relates to clamping devices and may be embodied in or applied to gripping jaws, such as those of bench or machine vices and the like. It has for its object the provision of means whereby work of objects of curved, irregular or assymmetrical shape may be automatically engaged and gripped or clamped firmly and with facility at a plurality of points. As the drawing illustrates, a cylinder block *A* of suitable dimensions for the jaws of the vice to which the clamping device is to be attached, is cast with a series of transverse bores, the axes of which are parallel to one another and to the direction of closing movement of the vice. The jaws of the latter are indicated at *B* and *C*. In the construction illustrated six bores are provided, and these bores are subsequently machined appropriately for constituting cylinders *D* for the reception of pistons *E*. A cover plate *F* is made for the front of the block *A*, the cover having bores corresponding to the piston members through which piston rods or plungers *G* extend forward from the cylinders a suitable distance according to the working range of the clamping device. The walls between one cylinder and the next are formed with ducts *H* such that all the cylinders are in hydraulic communication. The outer ends of the piston rods or plungers *G* are rounded as shown or may be otherwise formed in a suitable manner for work engaging purposes. Each piston member *E* is provided with sealing means slidably engaging its cylinder walling, and these means may be of any suitable known cup washer or other type of seal such as is indicated at *J*. The front cover of the cylinder block *A* has a downward extension or flange terminating in a nib or claw to engage under the hardened jaw plate secured to the vice jaw *B*. To secure the cylinder block to the vice jaw, suitable holes *K* are provided through the block into which set screws such as *L* may be threaded to engage the top of the vice jaw and thus clamp the block to the jaw with the claw engaged under the hardened jaw plate. In order to locate the work-piece *M* in the vice, the vice jaw *C* is provided with a jaw fitting member *N* which fits upon and is clamped to the jaw *C* in a manner similar to the block *A* and the extension on the jaw *B*. Thus the work-piece *M*, when in position in the vice, is clamped between the plungers *G* and the jaw fitting member *N*.—*July* 5, 1950.



No. 639,696

639,615. November 15, 1947.—Improvements Relating to Valves, Particularly Float-Operated Valves, Frederick Bennett Ellacott, of 16, Whyteleafe Hill, Whyteleafe, Surrey, and Thomas William Rook, of 2, Gainsborough Road, New Malden, Surrey.

This invention concerns improvements relating to valves, particularly float-operated valves, such as ball-cocks for water storage cisterns. The valve of the ordinary ball cock is liable to jam and cause overflow from the cistern and it is the particular object of the invention to provide a valve which is free, or substantially free, from this tendency. In the drawing a conical valve element *A* is formed or provided on the pivoted float arm *B*, the rounded apex facing upwards. The element is shown integral with the arm *B*, but it may be fixed or flexibly mounted. The seating element takes the form of a rubber washer *C* whose outer edge *D* is clamped between a gland nut *E* with metal washer *F* and a recessed enlargement *G* at the downwardly directed end of the water-supply duct or pipe *H*. The orifice *J* in the seating element is of frusto-conical shape, and is formed in an annular inner part of the washer which is quite free on both sides. In one suitable arrangement, the apex angle of the valve element *A* may be about 40 deg. and that of the seating orifice *J* about 60 deg. The upper side *K* of the free part of the seating element is not flat, but is of shallower conical shape than the orifice, having an apex angle of about 130 deg., so that initial contact between valve element and seating element takes place at the inner rim of a feather edge. When the float-arm rises and forces the conical valve element into the seating orifice the supply pressure of the water tends to press the feather edge of the seating element against the valve element, thereby ensuring a positive water-tight cut-off. Little stress will be exerted on the seating element, as the water will cease to rise in the cistern directly cut-off occurs. There is no tendency for the valve element to jam in the seating orifice. The metal parts of the ball cock should be of a non-corrosive metal. A stop *L* under the arm is provided on the pivot support *M* near the pivot *N* to limit the fall of the arm to a suitable amount.—*July* 5, 1950.



No. 639,615

INTERNAL COMBUSTION ENGINES

638,923. July 28, 1947.—Improvements Relating to the Exhaust Systems of Two-Stroke Cycle Internal Combustion Engines, Crossley Brothers, Ltd., of Openshaw, Manchester, 11; and Herbert Desmond Carter, of the company's address.

The exhaust system of a modern two-stroke cycle engine can be so arranged that as each cylinder in turn exhausts a substantial rise in pressure of a value of several pounds per square inch occurs in the exhaust manifold. This rise in pressure is of short duration and it can be arranged that it is followed by a period of depression below atmosphere. In accordance with this invention means for utilising the recurring pressure pulses in the engine

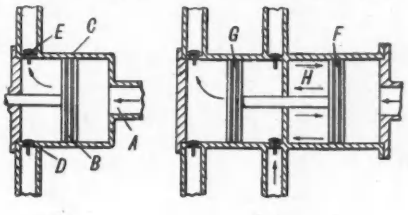


Fig.1 Fig.2

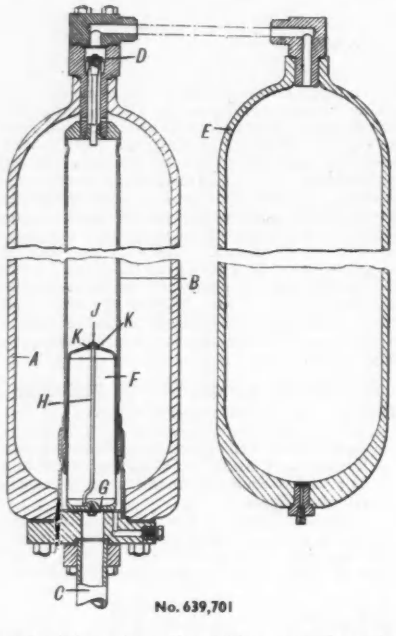
No. 638,923

exhaust system to perform useful work are provided. In Fig. 1 the branch *A* is in communication with the engine exhaust manifold so that the pressure pulses and the negative pressures which alternate therein act upon one side of the piston *B* in the cylinder *C* and cause it to reciprocate, with the result that air is drawn into the cylinder at the opposite side of the piston through the valve *D* and discharged through the valve *E*. Such air may serve as scavenging or pressure charging air for the engine. As shown in Fig. 2, two interconnected pistons *F* and *G*, the piston *F* being acted upon by the pressure pulses and the piston *G*, in conjunction with the suction and delivery valves forming a double-acting air compressor, may be employed. The piston *G* may act as a single-sided compressor, the other side of the piston forming an air cushion. In other arrangements a six-cylinder engine has its exhaust system divided into two separate exhaust manifolds, and these drive a double-acting air compressor or act in alternation upon one side of each of two pistons, the other sides of the pistons acting as air compressors. In another arrangement the exhaust pressure pulse acts on one side of a piston and transmits the load directly to the air at the other side of the piston. In all cases pistons may be replaced by diaphragms and air cushions by springs.—*June* 21, 1950.

HYDRAULIC MACHINERY

639,701. March 13, 1948.—IMPROVEMENTS IN HYDRAULIC ACCUMULATORS, Mactaggart, Scott and Co., Ltd., of Station Ironworks, Loanhead, Midlothian, Scotland; Robert Cairns Russell, of Ashbille, Roslin, Midlothian, Scotland; and Maximilian Frederik Gunning, of Little Hawsted, Steep, Petersfield, Hants, England.

This invention has reference to hydraulic accumulators of the type in which the fluid therein is loaded by compressed air. As shown in the drawing, the improved accumulator *A* is provided with a centrally disposed perforated guide tube *B* surmounting the usual discharge outlet *C*. The upper end of the accumulator communicates through an air valve *D* with a compressed air bottle *E*. Making a sliding fit within the perforated guide tube is a cylindrical float *F*. The bottom of the float carries a valve seating ring *G* which is arranged to register with a valve seat at the upper end of the discharge outlet of the accumulator. The top of the



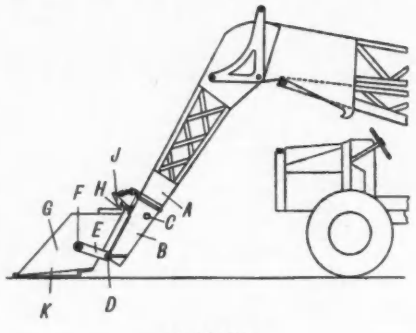
No. 639,701

float is of dome formation with a central opening through which projects the upper end of a tube *H*; the lower end of which is in close proximity to the bottom of the float. The upper end of the tube is protected by a small dome like cover *J* having openings *K* at the side, and the dome is arranged to co-operate with the stem carrying the air valve *D*. When the accumulator is discharging the valve seating ring *G* is raised from its valve seat and the air valve *D* is open, but when the accumulator discharges to a predetermined extent the float closes the discharge outlet *C*, thus preventing any possibility of air passing to the discharge. When recharging the float automatically rises and when fully charged cover *J* will co-operate with the valve stem to close the air valve thereby preventing the passage of liquid to the air bottle *E*. Should any liquid accumulate within the float, such liquid will be discharged automatically therefrom when liquid is drawn from the accumulator. This withdrawal results in a reduction in the pressure in the accumulator *A* below that of the air pressure within the float and the air within the float acts on the liquid therein so that the latter is ejected through the tube *H* into the accumulator. Such a float may therefore be said to be self-bailing.—*July* 5, 1950.

CRANES AND LIFTING APPLIANCES

640,013. June 4, 1947.—IMPROVEMENTS IN OR RELATING TO MOBILE CRANES, F. Taylor and Sons (Manchester), Ltd., and William Taylor, both of Barr Hill Works, 138, Bolton Road, Pendleton, Salford, 6.

This invention relates to an attachment for the jib of a mobile crane for the purpose of converting the crane into a digging or excavating and/or a levelling machine. As shown in the accompanying drawing, the member secured to the jib *A* consists of a sleeve *B*, which fits over the end of the jib, after the usual lifting hook has been removed, and is secured to it by a transverse pin or bar, which passes through holes *C* in the sleeve and transversely through the jib. A transverse rod *D* is carried by brackets attached to the sleeve *B*, the rod being located adjacent to the lower front edge of the sleeve and projecting laterally at each side. A link *E* is pivotally mounted on each end of the rod *D*, the other ends of the link being pivotally mounted on studs *F* projecting from the sides of the scoop *G*. A hooked-shaped projection *H*



No. 640,013

is secured to the top of the scoop at its rear edge and a catch *J* controlled by a spring is pivoted on a bracket affixed to the sleeve *B*, the catch being adapted to engage the projection *H* when the scoop *G* is in its operative position. The wall *K* of the scoop, which is in contact with the ground, is horizontal or substantially horizontal, as shown. The operation of the device is as follows: The jib *A* is lowered to bring the scoop *G* into contact with the material to be removed or the ground to be levelled and the crane is then moved forward, causing the scoop to dig into and become filled with the material. The jib is then raised until the scoop is clear and is then swung round into the position for discharging the material in the scoop. The spring catch *J* is released and the scoop moves about its pivots *F* and at the same time the links *E* pivot about the bar *D*, so that the scoop rapidly moves into a position for the discharge of its contents. Although not limited thereto, the attachment is particularly applicable for use with the jib described in the specification No. 618,793.—*July* 12, 1950.

Personal and Business

W. P. BUTTERFIELD, Ltd., of Shipley, has moved its Liverpool office to 28, Chapel Walks, South Castle Street, Liverpool, 1.

MR. M. F. DOWDING, M.A., A.M.I.Mech.E., has been appointed engineering sales manager of Davy and United Engineering Company, Ltd.

RANSOMES, SIMS AND JEFFERIES, Ltd., announces that Mr. W. D. Akester has been elected a member of the board of the company as the home sales director.

THE BENJAMIN ELECTRIC COMPANY, Ltd., announces that Mr. H. G. Campbell, assistant managing director, has been appointed joint managing director of the company.

POWER JETS (RESEARCH AND DEVELOPMENT), Ltd., announces that it has appointed as a consulting engineer Mr. George Jendrassik, an authority on gas turbine and diesel engines.

MR. C. R. MIDDLETON has been appointed manager of Shell's Stanlow refinery, Ellesmere Port, Cheshire, in succession to Mr. F. Mackley, who has been transferred to head office.

THE MINISTER OF TRANSPORT, the Rt. Hon. Alfred Barnes, M.P., has accepted the resignation of Mr. Percy Wharton from the Coastal Shipping Advisory Committee, and has appointed in his place Mr. Keith Douglas Jackson, deputy managing director of Coast Lines, Ltd.

BRITISH SCIENTIFIC INSTRUMENT RESEARCH ASSOCIATION announces that its Library and Information Department will shortly be transferred to the laboratories of the Association in Chislehurst. All letters and parcels should now be addressed to the Information Department, B.S.I.R.A., "Sira," Southill, Elmstead Woods, Chislehurst, Kent. The telephone number of the departments is now Imperial 2237.

A. A. JONES AND SHIPMAN, Ltd., Leicester, states that following its appointment as sole selling agents for the Micromatic Hone Corporation, Detroit, U.S.A., all necessary formalities have now been concluded and the company has acquired the rights to manufacture in this country, and the exclusive rights of sale in the British Commonwealth with the exception of Canada, the whole range of products manufactured by the Micromatic Hone Corporation.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of their insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

Association of British Chemical Manufacturers

Fri., Sept. 29th, to Sun., Oct. 1st.—Chemical Works Safety Conference at Scarborough.

British Association

Wed., Aug. 30th, to Wed., Sept. 6th.—Annual meeting in Birmingham.

British Institution of Radio Engineers

Wed., Sept. 27th.—London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1, Annual General Meeting, 6.30 p.m.

Incorporated Plant Engineers

Mon., Sept. 4th.—LONDON BRANCH: Royal Society of Arts, John Adam Street, Adelphi, W.C.2, "Heat Transfer from Condensing Steam," C. R. Crosse, 7 p.m.

Tues., Sept. 5th.—S. WALES BRANCH: Grand Hotel, Westgate Street, Cardiff, "The Applications of Ultrasonic Testing to Plant and Maintenance Engineering," J. W. Fox, 7.30 p.m.

Thurs., Sept. 7th.—PETERBOROUGH BRANCH: Eastern Gas Board's Demonstration Theatre, Church Street, Peterborough, talk by the President, E. G. Phillips, 7.30 p.m.

Institute of Metals

Mon., Sept. 18th, to Fri., Sept. 22nd.—Forty-Second Annual Autumn Meeting at Bournemouth.

Institute of Road Transport Engineers

Tues., Aug 22nd.—LONDON BRANCH: Visit to the works of Airscrew Company and Jicwood, Ltd., Weybridge, Surrey, 2.30 p.m.

Institution of Metallurgists

To-day to Sat., Sept. 30th.—Science Museum, South Kensington, London, S.W.7, Exhibition, "Metals in the Service of Mankind," weekdays, 10.0 a.m. to 6.0 p.m.; Sundays, 2.30 p.m. to 6.0 p.m.

Institution of Mining and Metallurgy

Tues., Sept. 19th, to Sat., Sept. 23rd.—Conference on Wire Ropes in Mines, at Ashorne Hill, Leamington Spa, Warwickshire.

Institution of Production Engineers

Tues., Sept. 5th.—LIVERPOOL GRADUATE SECTION: Exchange Hotel, Liverpool, "Lay-Out for Production," O. Blenkinsop, 7.45 p.m.

Wed., Sept. 6th.—LIVERPOOL SECTION: Radiant House, Bold Street, Liverpool, "Lighting for Production," W. Robinson, 7.15 p.m.

Scientific Instrument Manufacturers' Association

Tues., Sept. 5th, to Fri., Sept. 8th.—Exhibition and Symposium at the Examination Hall, Queen Square, London, W.C.1.

THE INSTITUTION OF ELECTRICAL ENGINEERS.—The London Students' Section of the Institution of Electrical Engineers draws attention to the fact that although the session proper will not start until October 9th when Mr. I. J. Shelley will deliver his Inaugural Address, a special meeting will be held in the Lecture Theatre of the Institution at 7 p.m. on Friday, September 1st. On this occasion Sir Arthur P. M. Fleming will deliver a lecture to approximately 100 foreign students who are spending three months in this country under the auspices of the International Association for the Exchange of Students for Technical Experience. The subject will be "Recent Developments in Engineering."